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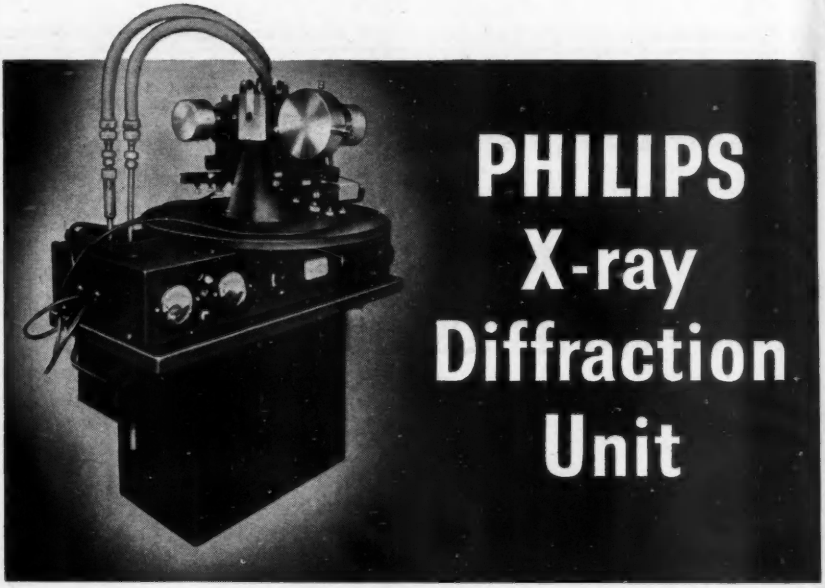
The Chemical Age

VOL LXVII 2 AUGUST 1952



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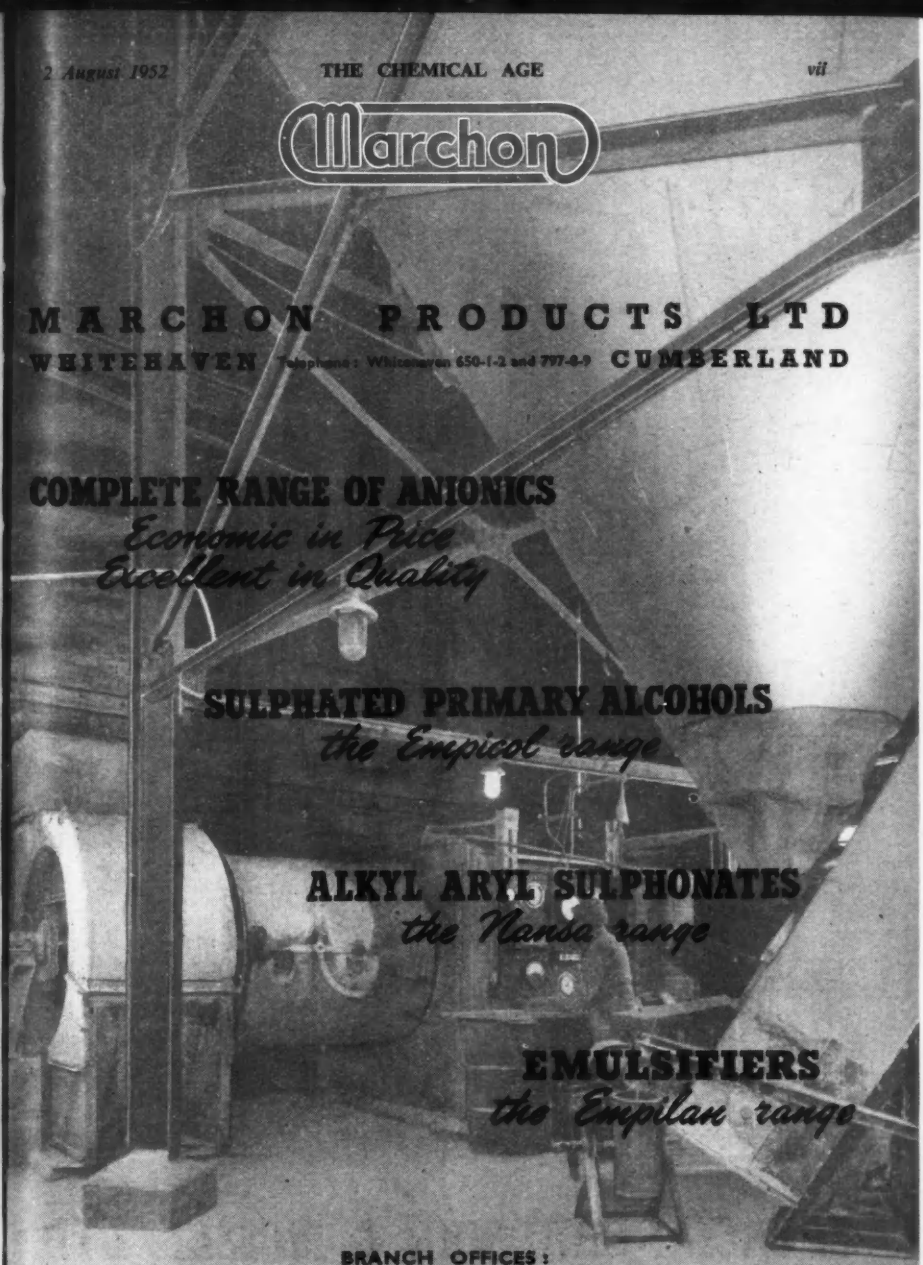

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The
Chemical Age

Established 1919
The Weekly Journal of Chemical Engineering and Industrial Chemistry

BOUVERIE HOUSE 154 FLEET STREET LONDON E.C.4
Telegrams: ALLANGAS FLEET LONDON · Telephone: CENTRAL 3212 (26 lines)

Volume LXVII 2 August 1952 Number 1725

Chemical Progress in Medicine

LAST year (CHEMICAL AGE, **65**, 751) we discussed in a leader the Medical Research Council's Report for 1948-50; now, in little more than six months, we are able to digest the 1950-51 Report (HMSO, 6s.). If this means that yet another return to a pre-war tradition of annual publication has been achieved, it will be widely welcomed. In the new Report, as in its predecessors, chemical topics are well to the fore in the aspects of medical research selected for special commentary. Not a generation ago the most glittering opportunities for organic chemists were to be found in medical or biochemical research. Since then the great advances of polymer fabrication and the rise of industrial organic chemistry may seem to have changed this picture, but the truth remains. It is still in the medical field that chemical jugglers with groups and chains and rings can make their finest contributions to the betterment of mankind. It is a field, too, in which pure as opposed to applied, research has undiminished importance. By itself the section on proteins establishes this. Proteins are more than building blocks in nutrition and growth. The controlling enzymes of the body, most of the hormones, the toxins produced by invading organisms, all these are also proteins. Individual advances on this front may take place but nothing will propel a broad and general advance more than fundamental research into the structure and nature of proteins. Purification of proteins by electrophoresis, the ultracentrifuge and the electron microscope, modern chromotographic analysis and radio-isotope 'labelling', are modern methods of investigation which are being used in protein research under the aegis of the Medical Research Council. Already the resistant problem of protein molecular structure seems to be yielding —a general pattern, if not a detailed blue print, has been fairly clearly established.

The new anti-T.B. chemicals—iso-nicotinic acid hydrazide and its iso-propyl derivatives—are being studied in British clinical research, recent though their development in the United States has been. But there is a hint of another development that may be equally important in the new British Report. In animal tests certain non-ionic surface-active chemicals have been found to produce striking antituberculous effects. Oddly, these substances have no action upon the bacillus in test-tubes; unlike other agents of this kind they exert their powers on the body, stimulating its natural defences against T.B. bacilli. So far, however, the age-old difficulty of toxicity stands in the way of wider development, but new research is aimed

at producing substances that are more active yet less incidentally toxic. The role of surface activity in biochemistry seems to require intensive study. It is only recently that American research has found that growth-acceleration in animals can be accomplished by trace supplies of surface-active substances as well as by antibiotics. As for antibiotics in medicine, impressive progress is again reported but, not unexpectedly, the far more favourable supply position of the newer antibiotics in America results in the fact that U.S. experience in usage is several years ahead of British experience. This is not entirely regrettable, however, for as supplies reach this country on an increasing scale we are able to put them into action without great delay. The Medical Research Council has not felt it necessary to start from zero—'clearly the main findings of the American work needed no confirmation . . . .' Aureomycin, chloramphenicol, and terramycin are now being developed partly on the basis of accepting prior American results and partly to check whether disease severity differences between Britain and America lead to differing responses. A new name in the long list of antibiotics—polymyxin E—may soon become more familiar. Though one of the antibiotics whose internal use is prevented by toxic hazards, it can be safely applied to an accessible site of infection; the Council's Burns Research Unit at Birmingham has shown it to be remarkably effective in healing infected burns.

The regular importation of cortisone and ACTH—begun by the Ministry of Health in 1951—has enabled British research in this dramatically hopeful field to be freed from many of its earlier handicaps. Joint Anglo-American work in the use of these two drugs to treat rheumatic fever is already in progress. Cortisone has been shown to have some limited but again dramatic usefulness in treating eye diseases. Home production of ACTH has begun and is being encouraged by a special MRC committee; the major problems being encountered are the scarcity of animal pituitary glands and the cumbersome animal tests required to standardise the potency and purity of the final product. In both these directions strenuous efforts towards improvement are being made though the second problem seems the more intractable. Perhaps the most notable advance in this field is the discovery by a team of MRC workers sent to Kenya that hecogenin, a starting material for cortisone synthesis, occurs in sisal waste and juice; indeed, it can be quite cheaply and readily extracted from the juice. This is a piece of British research that would seem to have greatly enlarged the prospects of cheaper and ampler supplies of cortisone.

On Other Pages

The annual subscription to THE CHEMICAL AGE is 35s. Single copies, 9d.: post paid, 1s.: SCOTTISH OFFICE: 116 Hope Street, Glasgow (Central 3954/5). MIDLANDS OFFICE: Daimler House, Paradise Street, Birmingham Midland 0784-5). THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited.

Notes & Comments

Chemical Crop Drying

'ALREADY a fair amount of grain is damaged in a wet harvest and in any year from 1952 onwards this damage may become widespread and serious from the national point of view. Action is therefore urgently required in the following directions: A greater rate of installation of drying plants and storage on farms. Increased intake, drying and storage capacity by merchants and processors, involving a corresponding increase in the physical movement of grain.' This is an extract from the recently published Working Party Report on 'Grain Drying and Storage in Great Britain.' The severity of the problem facing farmers and the cereal trade each year is new in size if not in nature, caused largely by the ever-increasing introduction of combine harvesters. The separate operation of threshing no longer 'staggers' grain availability over a long period; but storage and collection arrangements have not kept pace with this development.

American Trials Successful

A CONTRIBUTION towards easing this problem might be made by chemicals. Its possibility does not appear to have been considered by the Working Party. If some days before harvesting crops are sprayed with chemical de-foliating agents, one result is that moisture stops passing from plant roots to the ripening grain. The natural fall in the grain's moisture content is markedly accelerated. In some experiments in Texas with the rice crop, rice grain with an original moisture content of 23 per cent to 25 per cent showed a drop of 2 per cent per day after treatment. Usually the rice grown in Texas has to be artificially dried—with the pre-reaping use of chemicals it was found possible to avoid this. The cost of the chemical treatment was only half that of drying. The substances so far used are chlorates, sodium cyanamide in solution, calcium cyanamide as a dust. It is said that harvests may actually be increased. This is due to the fact that ripening is more even after de-foliation and the usual losses of over-ripe and under-ripe grain are minimised. In America the new method has also been applied to crops grown for seed—clovers, grasses, lucerne. In Britain some experiments on our barley crop were planned to start this July. Present figures suggest that the harvest of barley grain exceeds the total intake capacity of users and merchants by 100,000 tons. Can chemical spraying help to solve this type of problem?

Dangerous Knowledge?

IN the recent rapid growth of material knowledge is mankind apt to overlook the dangers which may accompany it? This acquisition of new knowledge, Mr. H. W. Cremer, president of the Royal Institute of Chemistry, has pointed out, is often brought before people without sufficient effort on their part to acquire it properly or to understand where it may lead them. Mr. Cremer, who was speaking at the Fourth Chemical Works Safety Conference (proceedings of which have now been published), was naturally mainly concerned with industrial health and safety. He drew attention to the fact that new chemicals are being thrust upon the world, or old ones resuscitated for new purposes, at an alarming rate, but the study of their potential harmfulness to man is far less adequate. Conditions have, of course, improved tremendously in recent years and there is a far greater awareness of hazards and need for safety precautions than ever before, nevertheless there is still much room for improvement.

'Ut Prosim'

OF all the industrial organisations the Association of British Chemical Manufacturers has done the most to make safety an integral and accepted part of its life's work, and the Latin motto 'Ut Prosim' (that I may do good) might, as Mr. Cremer suggested, be aptly applied to it. Inculcation of a conscious-

ness of the hazards to safety should, in the opinion of Mr. Cremer, be a continuous process starting from school and extending through life. In support of this contention he put forward two suggestions by which the ABCM might give still further help. First, could it not do something to persuade the writers of textbooks, even of the elementary variety, to indicate that a knowledge of the physiological properties of chemical substances should be regarded as quite as fundamental and essential as their chemical and physical properties? Secondly, could not it assist in bringing back men from industry to academic life? It was admittedly a lot to expect of an employer to make it easy for a valued member of his staff to absent himself for a short time, let alone for good; but this would help university life to become more realistic without in any way losing its distinction. While scientists are today generally less aloof from material things, and the summer schools have done much to strengthen the link between the scientist and industrialist, Mr. Cremer's note of warning deserves the serious consideration of all concerned, whether engaged in academic or industrial research, or those whose duty it is to create and cause to be operated the process equipment with which these researches may be implemented on the manufacturing scale.

Research in British Industry

ESTIMATION of expenditure on research and its value covers so many varying features that it must always be an extremely difficult problem to assess. This applies particularly to the last five years in Britain where research and development have been hampered by restrictions on capital expenditure and shortage of qualified staff. Nevertheless some interesting general conclusions and comparisons have been arrived at in the second survey of research and development in British industry made by the Industrial Research Committee of the Federation of British Industries and covering the year 1950-51. This survey, based on 301 firms each spending not less than £2,000 a year on this work, shows that nearly £24,000,000 was expended during the period under review, compared with £21,815,000 by 420 firms in 1945-46 and £5,442,000 by 566 firms in 1938. This suggests an increase of not less than 50 per cent in expenditure compared with 1945-46. Chemicals, naturally, play a predominant part. Expenditure of £8,903,000 was made by 64 firms, which was 2.4 per cent of the turn-over. In this group a total research and development staff of 10,705 was employed, of whom 3,168 were qualified. Chemists were still among the most numerous qualified staff, though their increase (25 per cent) was not as remarkable as that of engineers (85 per cent). Total expenditure is, however, not altogether a satisfactory guide to the volume of research and development, particularly bearing in mind that inflation has reduced the value of the £ and resulted in increased expenditure in terms of both salaries and equipment. It is interesting to note that 69 to 98 per cent, according to the industry, of the total research and development is incurred on projects originating within the firm. Nearly all the remainder is on projects resulting from technical sales service. Only one or two per cent of the total is spent on outside or sponsored research. The proportion of firms which are members of a co-operative research organisation (usually a research association) has not changed appreciably since the 1945-46 survey. Floor space of research and development departments in chemicals increased by 62 per cent over the last survey.

Friction over Monazite Sands

Thorium-containing monazite sand in India is reported to be causing friction between that country and the U.S.A. Two years ago the U.S.A. shipped wheat to India (paid for by a U.S. loan) and agreed to supply India with the technical assistance necessary for her to build a thorium extraction plant, on condition that she was allowed to purchase some of the thorium-containing material. So far the U.S.A. has not received any of the strategic sands, and India has said she needs it for her own atomic development. U.S. experts say that Indian atomic development is at least 20 years away.

Research as a Source of New Knowledge

Mellon Institute's Growing Range of Investigations

THE beneficial impact on science and technology of the Mellon Institute of Pittsburgh, Pennsylvania, U.S.A., because of the determination of its whole group to gain and hold a real pre-eminence in pure as well as applied research is well illustrated by the 'Research Proceedings of the Mellon Institute, 1951-1952' (Annual Report Series, No. 39).

Founded in 1913 the Mellon Institute is an endowed non-profit corporate body for conducting comprehensive investigations on important problems in the pure and applied natural sciences, for training research workers and for providing technical information adaptable to professional, public and industrial advantage.

During the fiscal year 1 March, 1951, to 1 March, 1952, expenditure by the institute for pure and applied research amounted to $3,835,314. Of this sum $727,654 was spent on supporting investigations in pure science in the institute's research department and on nine Fellowships.

Applied science researches of the institute were conducted by 77 other Fellowships, employing 441 members. Seven new Fellowships entered on their programmes during the year. Seven others have been accepted and are waiting to begin as soon as personnel and facilities are available, and 20 proposed Fellowships are under consideration.

An important event was a two-day 'Open House' held on 15-16 September, which gave the public a first chance of seeing the institute since the dedication of its present home 14 years ago. The choice of this date was influenced by the 75th anniversay of the American Chemical Society and the close of National Chemistry Week.

Work Evenly Divided

In the department of research in chemical physics work had been fairly equally divided between research assistance to the Fellowships and an expanding programme of basic investigation. In general, studies were devoted to fundamental applications of X-ray diffraction and spectroscopy in analysis and structure determination.

The spectroscopic division had progressed in its programme of vibrational analysis of simple molecules, and had utilised ultra-violet, infra-red and Raman spectra for the structural characterisation of molecules, and had fostered a long-range schedule for the improvement of emission spectrographic techniques.

Studies of the X-ray division pertained to chemical and physical applications of diffraction, to structure determination in amorphous materials, and to single crystal analysis both at room and low temperatures.

An Interesting Molecule

Dicyanoacetylene, N≡C-C≡C-C≡N, was considered an interesting molecule for rigorous structural study for two reasons: no molecule with three conjugated triple bonds had so far received such an investigation, and it was also one of the longest complete linear molecules at present described.

A quantity of eight grammes of the material was prepared by a difficult synthesis. The infra-red spectrum had been studied in detail, but the Raman spectrum was so far only partially completed. The electronic absorption spectrum of the compound had been measured on a two-meter grating spectrograph and was found to exhibit a number of discrete bands.

Interpretation of these bands must await completion of the vibrational analysis and measurement of the fluorescence spectrum.

To complete the molecular and structural study of dicyanoacetylene its crystal structure was determined from precession photographs taken at 0°C. Its two-molecule cell had the symmetry of monoclinic space group C_{2h}^5—$P2_1/a$, and the following dimensions: a_o=8.93 A., b_o = 6.04 A., c_o = 3.86 A. and β = 99°20′.

Positions of the atoms within the cell were obtained initially by trial-and-error methods, and then refined by Fourier and least square procedures. Interesting features of the molecule were its linear configuration and its bond lengths: C≡C 1.19 A., C-C 1.37 A. and C≡N 1.14 A.

Infra-red study of inorganic salts has so far received little attention and an investigation was undertaken with the dual goal of finding frequencies characteristic of the

various polyatomic inorganic ions and of ascertaining the utility of such spectra in analysis. After developing experimental procedures, the spectra of 160 salts were recorded.

From these spectral curves characteristic frequencies for 33 ions were tabulated, and a comparison made between Debye-Scherrer X-ray diffraction patterns, emission spectra and infra-red spectra for the qualitative analysis of mixtures of inorganic salts. The three methods prove to be complementary and together provided much more information than any one alone.

New Theory of Distillation

In the department of research in physical chemistry work was being carried out on a project which represented a wholly new field of theory of distillation in treating the problem of the wetted wall column from the rigorous standpoint of the diffusion equation in each phase.

Findings of this investigation, expressible as a series of complex parabolic cylinder functions, gave numerical information on the relative importance of diffusional resistances in the two phases.

The department of analytical chemistry provided analytical services entirely within the institute. Control analyses, analyses of research materials, development of new analytical methods and techniques, and consultation with Fellowships on analytical problems were all functions of the department, which also supplied standardised solutions, standard samples and special reagents to Fellowships performing control analyses in their own laboratories.

Nearly 2,000 samples requiring about 6,000 separate determinations were handled during the year. These included ores, ferrous and non-ferrous alloys, dusts, synthetic inorganic chemicals, natural and synthetic organic materials of wide variety, water and gases. The diversity of materials and the special nature of some of them necessitated the use of more than 100 distinctly different methods or techniques, many of which had to be modified for employment with specific samples.

Facilities were being expanded to enable more efficient work and to make available a wider variety of techniques. As new instruments and apparatus were acquired, techniques were investigated to broaden their applications to the many problems involved in analyses of such diverse materials as were submitted.

In addition, a research programme was being developed to investigate new methods which might improve the accuracy, precision or efficacy of certain analyses. As a major part of this programme, joint studies had been undertaken with a number of Fellowships, with a view to improving existing techniques or to devising new methods for handling their specific problems.

The Industrial Hygiene Foundation, which operates under the auspices of the Mellon Institute, held its 16th annual meeting during the year.

Technical aspects were covered in a series of four conferences. The medical conference discussed current problems in industrial medicine. The legal conference dealt with air and water pollution and with workmen's compensation. The chemical-toxicological conference included items on poisonous substances, radioactive materials, noise and analytical procedures. The engineering conference devoted time to industrial illumination, exhaust ventilation, dust measurement and air pollution.

During its 14th year the Multiple Fellowship on Chemical Hygiene of the Union Carbide and Carbon Corp., New York, N.Y., proceeded industriously in its wide programme of outlining the quantitative and qualitative pharmacology of useful new chemicals. Preliminary studies were conducted on 40 materials, and advanced investigations were made of 20 compounds which might have valuable applications in pharmaceuticals, cosmetics, food packaging or as pesticides, and of eight materials which might be contacted chiefly by industrial workers. Five scientific publications communicated the results and conclusions of detailed researches upon four technically important chemicals and of preliminary studies of 120 newer materials.

Fellowship More Active

The Fellowship had become more active in presenting its viewpoints, information and opinions to groups of other specialists and of laymen.

As in past years the Multiple Fellowship on Sulphur, whose donor was the Texas Gulf Sulphur Co., New York, N.Y., had been engaged in researches on the recovery of sulphur from various sources. In addition,

information had been published on corrosion by sulphur, on the metering of the liquid and on the thermal conductivity of the vapour (at 1 atmosphere, computed as a function of temperature).

An earlier article on corrosion by sulphur was revised. The major change was a completely rewritten section on stainless steel, bringing up to date the information about its resistance to sulphur.

Transportation of sulphur in the molten state and its vapour-phase reactions had been carried out successfully because of the development of heat- and sulphur-resistant materials. Such corrosion-resistant materials might aid in the use of sulphur as a medium of heat transfer. At present cast iron and steel predominated in commercial usage, not because they were especially resistant, but because they were cheapest.

There was no guarantee, however, that more economical materials could not be produced. It might be possible, for instance, to electroplate tantalum on a stainless steel and then to anodise the tantalum. If the tantalum layer should be dense and impervious, sulphur probably would not affect the surface since tantalum sulphide did not form when tantalum pentoxide was heated with sulphur.

In co-operation with engineers of the donor, a comprehensive study was made of the metering of liquid brimstone. Liquid sulphur had been metered in quantity meters, head meters, a rotameter and weirs.

Completion of the initial phases of research and development on organic complexes of the colloidal clays was fulfilled. and members of the Fellowship (Lead) entered the employ of the donor organisation, the Baroid Sales Division of the National Lead Co., Houston, Texas, to broaden this work on a commercial basis. A new programme was begun and new Fellowship personnel acquired for fundamental extension of the 'Bentone' research. A paper on organophilic bentonites was presented in the symposium on clays at the autumn meeting of the American Chemical Society.

Long-Range Programme

In July, the Refractories Institute, Pittsburgh, Pa., became the donor of the Multiple Fellowship on Refractories, and shortly afterwards a long-range programme was set up.

The Multiple Fellowship on Chemical Storage, whose donor was the Pittsburgh-Des Moines Co., Pittsburgh, Pa., had conducted an effective research programme.

One of the principal purposes for which this Fellowship was founded was to develop by research the most suitable materials for use in the construction of tanks to contain various commercially important chemicals. In the 38th Annual Report there were listed 44 substances that had been investigated and covered by separate descriptive accounts giving complete information on construction metals, piping, valve and gasket materials, and coatings to protect the structure itself and coatings to prevent contamination of the stored materials.

Additional Reports Published

During the past year similar reports had been prepared on seven additional substances, as follows: aluminium fluoride, bauxite, coke, cryolite, fluorspar, anhydrous hydrogen chloride and vinyl chloride.

The 'Icosasphere', a Fellowship development enabling a metal sphere to be constructed from practically rectangular plates with very little scrap, had increased acceptance. 'Icosaspheres' were being built in many parts of the country, some of them as large as 65 ft. in diameter and some for pressures as high as 200 p.s.i.

During 1951 the Fellowship devised an improved method of measuring stresses in large steel-plate structures where it was necessary to ascertain the stress simultaneously both on the inside surface which was in contact with liquid and on the outside surface exposed to the weather.

This work had given information on the stress intensities of various tank members, resulting in better designs and economies in the use of scarce materials.

Research on the burning of natural gas was being transformed into a large gas-fired air heater for use in high-temperature testing. The Fellowship had determined quantitatively the scaling of the various metals that could be employed and the combustion characteristics of the special burners utilisable in the heating furnace itself, which operated mainly on the principle of heat transfer by radiation.

Preparation and appraisal of new iodine compounds headed the experimental work conducted by the Fellowship (Iodine) of the Chilean Iodine Educational Bureau, Inc., New York. Included in the year's work was an evaluation of iodine as a germi-

cide for heat-sensitive textile fibres. Preliminary tests showed that the concentrations necessary for sterilisation did not damage the fibres. Practical application is foreseen in using an iodine bath as a step in laundering.

Improvements in the properties of all types of match in common use were investigated by the Fellowship on Match Technology, sponsored by The Ohio Match Co., Wadsworth, Ohio. It was expected that within a short time the boxes of all safety matches as well as the covers of book matches would be supplied with an effective water-resistant and moisture-resistant striking surface.

Organic Synthesis

In the section devoted to synthetic organic chemistry were summarised the many 1951-52 researches of the Multiple Fellowship on Organic Synthesis. The Fellowship was maintained by the Union Carbide and Carbon Corporation, New York.

Interest in new products had prevailed at a high level, some 90 miscellaneous preparations being made to supply samples of plasticisers, agricultural chemicals, pharmaceutical intermediates, odourants, dyestuff intermediates, textile specialities, polymerisable monomers and the like.

Favourable findings with earlier samples had resulted in the pilot production of 2,2-diethyl propanediol-1,3 as an anti-convulsant, 2-butyl-2-ethyl propanediol-1,3 as a component of a military insect repellent, fatty acid glyoxalidines for surface-active application, benzyl-ethylene diamine for textile use and acetoacetamide for dyestuffs. Some attention was given to corrosion inhibitors for use in packaging miscellaneous metal objects.

Several new reactions of diketene with the sodium derivatives of pentanedione and acetoacetic esters were discovered. The identity of the end-products as orcinol and dimethyl pyrone derivatives was established, and the several mechanisms involved were elucidated. The knowledge gained might lead to other reactions and products of a more practical nature.

A most unusual and possibly important reaction was found in the polymerisation of diketone to dehydroacetic acid. There resulted dehydroacetic acid of high purity, uncontaminated by by-products, in yield equal to that by any other known procedure. It was found possible to prepare, for the first time, *o*-nitroacetoacetanilide from diketene and *o*-nitroaniline.

A programme for the study of the effects of chemicals on cellulosic and synthetic fibres had been inaugurated. In time the results might be translatable into treating-oils, lubricants, dye assistants, sizes, insolubilisers and the like, for general textile- and paper-processing operations.

A new series of non-ionic surface-active agents had been elaborated whose function in water solution was not grossly influenced by concentration, temperature, or the presence of polyvalent metal ions and neutral electrolytes. Utilisation of a novel class of hydrophobes permitted the production of agents of good detergent properties in liquid, wax or flake form.

Polypropylene glycol esters of 2,4-D and 2,4,5-T acids that were non-volatile, high in herbicidal activity and completely oil-miscible had been produced in pilot-plant quantities for field testing.

Versatility of 'Vinylite' resin dispersions had been extended by the development of plastigels. These putty-like materials, prepared by adding thickening agents to plastisols, had important industrial promise.

The Multiple Fellowship (Nickel) of The International Nickel Co., Inc., New York, N.Y., had given most of its research attention to studies of (1) the detergent and other properties of oil-soluble nickel compounds, with the objective of establishing their suitability as lubricant additives, (2) the wetting properties of nickel subsulphide on various catalyst supports, and (3) the effect of varying conditions of precipitation upon the characteristics of nickel hydroxide. The lubricant-additive programme was continued productively from the previous year. Many of the various metal compounds used in this investigation were synthesised in 1951.

Heavy-Metal Salts

During the course of the investigation on nickel hydroxide a new method for the study of basic heavy-metal salts was discovered and applied to the basic salts of nickel. Some of the factors influencing the composition and other properties of the basic carbonates of nickel were also clarified, so that a catalyst intermediate having certain predetermined properties could be prepared. This information will constitute the sub-

ject matter of several forthcoming publications.

Less comprehensive projects of the Fellowship have explored nickel-stabilised azo dyes and also *iso*cyanide-substituted nickel-carbonyl compounds.

The investigational programmes maintained at Mellon Institute by Koppers Co., Inc., Pittsburgh, Pa., were concerned with fundamental scientific research and with basic problems arising from the manufacturing functions of the donor's plants. During the past year the termination of certain of those Fellowships engaged primarily in applied research and donor service activities was occasioned by the construction of a new company research laboratory, the Koppers Research Centre at Verona, Pa.

As hitherto, the Multiple Fellowship on Aromatic Anhydrides has studied catalysts for the manufacture of phthalic anhydride. The effect of variations in the physical and chemical make-up of the catalysts was determined in life tests carried out on a pilot-plant scale. It was also demonstrated in pilot-plant tests that particular operational difficulties experienced in commercial equipment were caused by certain impurities present in the raw materials.

Efforts of the Multiple Fellowship on Effluents Treatment were applied mainly to research on the chemical, physical and biological characteristics of effluents from donor chemical manufacturing and by-product coke operations and of receiving waterways. Laboratory investigations as well as extensive field and plant surveys, in co-operation with the technical staffs of several of the donor's plants, contributed important information regarding waste treatments and disposal problems.

Effluent Refinement

Knowledge thus obtained on the waste liquors led to recommendations that resulted in the refinement of effluents from some plants with simultaneous further diminution of any contaminants discharged to the receiving watercourse or atmosphere.

A new series of polyfunctional monomers was synthesised and evaluated in polymerisation by the Multiple Fellowship on Monomers. It is believed that these products will evoke considerable commercial interest. An extended study was made of the catalytic dehydrogenation of a series of alkylated benzenes, establishing the yield of reactive monomer and isomer composition as a function of preparative conditions. Numerous plant problems associated with hydrocarbon alkylation and dehydrogenation were solved.

Work on silicones by the Multiple Fellowship (Silicones, formerly Technical Glassware) sustained by the Corning Glass Works, Corning, N.Y., and the Dow Corning Corp., Midland, Mich., had advanced on a broad scale.

Two years ago mention was made of new silicone polymers for the development of water repellency in textiles. These chemicals had been improved to the point where they were highly repellent to water-borne stains. Of perhaps even greater interest was the fact that they gave particularly good results when applied to fabrics produced from synthetic fibres, such as rayon, nylon, 'Orlon' or 'Dacron'. The conventional waterproofers are less effective on these fabrics than on natural fibres.

This unique adaptability of the silicone water repellent was important at a period when the synthetic fibres were demonstrating their usefulness in many different fields.

Silicone Rubber Production

IT has been announced by Midland Silicones Limited that the plant now being constructed by Albright & Wilson Limited at Barry, Glamorganshire, for the manufacture of silicones is expected to come progressively into full production during 1953. To meet the steadily increasing demand for silicone rubbers a major alteration to those plans was made some months ago so that silicone rubber should be the first silicone product to be made in Britain. That has been achieved and certain grades of silicone rubber are now being manufactured, though not without partial dependence upon U.S.A. imports.

All silicone rubber will be called 'Silastomer' the registered trade mark of Midland Silicones Limited. This name will be given to both the imported Dow Corning 'Silastic' and the material made in Britain.

It is understood that production will initially be confined to grades which are in the greatest demand, and the range will be extended as quickly as possible. British Silastomer will be supplied freely up to the capacity of the plant with priority to defence orders.

Fifty Years of Water Purification

Paterson Engineering Celebrates Jubilee

AT a reception held recently in the hall of the Worshipful Society of Apothecaries, the Paterson Engineering Company celebrated its Golden Jubilee.

The history of the company is closely bound up with the person of its founder, Sir William Paterson, who was present at the reception. In 1902 he formed the company to meet an urgent need for some means of stopping disastrous explosions in water-tube boilers that were frequently occurring. This he succeeded in doing by developing a filter which removed oil from the boiler condensate.

Real Work Begun

His most important work, however, was begun after 1910, when the introduction of the steam turbine rendered oil eliminators unnecessary, and he turned his attention to the purification of water.

Adapting his earlier patents, he designed the Paterson Rapid Gravity Filters, which reduced the need for costly slow sand filters by pre-filtering the water before it passed through the sand. Rapid filters operate at 50 times the speed of slow sand filters, which were in general use in Britain until Paterson introduced his system and greatly reduced the time and expense of cleaning sand filters. With the filters, he developed other apparatus for sterilising, softening, and decolorising water.

In 1922 Paterson was asked if he could devise appliances to prevent the growth of algae on the condenser tubes of electric generators. He designed a sterilising plant using chlorine gas which brought about a saving of probably 500,000 tons of coal annually in Britain alone, as well as the cost of cleaning the tubes.

At about the same time, following London's severe drought of 1921, Paterson designed and installed the first primary filters introduced to the system of the Metropolitan Water Board, and extended them to filter 108,000,000 gallons daily. His apparatus reduced the cost of installing filter plant by 55 per cent, as well as cutting maintenance costs.

Many of Paterson's biggest projects have been abroad and in the Commonwealth. For more than 30 years his branches in Bombay and Calcutta have been carrying out research into the problems of bacterial pollution and silt in India's rivers. Egypt, the Sudan, Iraq, Hong Kong, China, Japan, New Zealand, Malaya, South Africa, the Argentine, Estonia, Belgium, and Holland, are other countries where large filtration works have purified the waters of turbid rivers and infected springs.

Plant was recently installed for purifying the water for this year's Olympic Games at Helsinki. Other examples are in use in the liners *Queen Mary* and *Mauretania*, in paper mills making bank notes, on farms supplying T.T. herds, and in national research laboratories.

Sir William Paterson, who was knighted in 1944, has filed seventy British patents covering many aspects of water purification and including small domestic filters, portable sterilisers for armed forces in war time, ozone treatment plants for breweries, dairies and mineral water factories, as well as filters and chlorinators.

At the reception Lord Waverley, who was present, produced the original model of the Anderson air raid shelter, which Sir William Paterson designed at Lord Waverley's request in 1939. The design was patented to prevent its commercial exploitation, and the patent presented to the nation by Sir William.

Increased Sulphides Recovery

LABORATORY experiments carried out by the U.S. Bureau of Mines at the Mississippi Valley Experimental Station have indicated that increased recovery of lead, cadmium and germanium sulphides from zinc sulphide concentrates may be possible. Volatilisation in both reducing and inert atmospheres, as well as in a partial vacuum, have resulted in recoveries as high as 90 per cent, it is reported. Temperatures used varied from 700-1050°C. Free copies of the publication describing the experiments—Report of Investigations No. 4876—may be obtained free from the Bureau of Mines, Publications Distribution Section, Pittsburgh 13, Pa.

The Rational Selection of Refinery Furnaces

DESIGN methods for direct-fired furnaces, central unit for many refinery operations, have in recent years undergone an important evolution. With the growing array of experimental and performance data, more rational guiding principles have become available to the refinery engineer for the selection of fired heaters which will prove most suitable for the job at hand.

Numerous types of furnace are today offered by various manufacturers, differing mainly in arrangement of tubes, walls and flow passages—but often only in trade name. A careful evaluation of the merit of different types is necessary before proper selection can be made. As an example, vapour-phase cracking and similar temperature-sensitive operations are best carried out in a vertical, single-passage furnace of the DeFlorez type which has the advantage of permitting careful heat control and temperature uniformity, while suffering from low thermal efficiency and relatively high first cost.

The first problem facing the engineer in the selection of fired heaters is the question of vertically or horizontally orientated tubes. This decision is influenced above all by the considerations of economic factors, and process requirements.

Tube Box Furnace

Probably the most common type of furnace found in such non-specific functions as crude oil heating is the horizontal tube box furnace employing separate radiant and convective sections. This type is particularly desirable where final costs are high, and it can be readily adapted to handle inferior grade fuel oils, notably oils of high ash content. Units of this type can be designed to permit access to the exterior surface of the convective tubes, while the radiant section continues on stream.

A variation of this type of horizontal-tube furnace is employed to advantage for the dual functions of heating and vaporising an oil. The hot oil is flashed in an external drum and the vapours are subsequently superheated to the required temperature. A typical furnace of this type, offered by Foster-Wheeler Corporation, maintains minimum pressure drop through the unit by the arrangement of the tubes in a multiplicity of parallel streams. This results in processing advantages but introduces an operating difficulty by minimising the evidence of coke obstruction which is otherwise readily indicated by rising pressure drop.

An important type provides a circular arrangement of vertical tubes. Fuel gas flow may be in a downward direction, but is more commonly directed upward to minimise the required accessory equipment. Heat transfer is predominantly by radiation. A convection section may be superimposed by suitable elongation of the process tubes into a separate chamber. Furnaces of this type are quite costly, largely due to the need for a very large superstructure which is to facilitate the removal of tubes through the top.

Furnace Modified

The vertical gas-flow type of furnace may be modified by the installation of horizontal tubes in both radiant and convective sections. This reduces the uniformity of temperature which can be achieved, but it also lowers the cost of the furnace by facilitating the maintenance problem in tube removal.

To the furnace designer of today, it is no longer enough to know the total rate of heat which can be transferred per unit time. It is of almost equal importance to have an understanding of the behaviour pattern of the individual tubes, both as compared to other tubes in the furnace and along various points of the same tube. Obviously, this introduces a very complex study, but it is essential to analyse these factors in many instances in order to minimise yield-consuming side reactions and to prevent the local formation of obstructing coke.

A recent study by the Foster-Wheeler Corporation shows the manner in which the actual heat transfer varies around the perimeter of a given tube in the radiant section. Heat is received by three different modes: (1) as direct radiation from the combustion gases in the furnace, (2) as indirect radiation from the combustion gases in the fur-

nace by re-radiation from the furnace wall, and (3) as indirect re-radiation from the combustion gases by re-radiation from the adjacent tubes. A careful study of the factors involved shows that the principal means at the designer's disposal for promoting circumferential uniformity of heat transfer rest (a) in providing large spacing between tubes, and (b) in providing firing on both sides of the tubes. The extreme case of dual firing is, however, hardly ever economically justified.

Heat Transfer Distribution

The axial heat transfer distribution along any given tube tends to be more uniform in the case of horizontal than of vertical tubes. This is due, above all, to the greater uniformity of flame distribution in a horizontal plane. Greater evenness can be achieved in vertical-tube furnaces by providing as long a flame as possible (usually at a cost in thermal efficiency). An interesting alternate approach in this direction has recently come into fashion (e.g., at the Watson, Cal., refinery of Richfield Oil Company). In this installation, a vertical-tube furnace is fired by downdraught. A refractory cone is provided in the bottom in order to promote radiant heat transfer in this region.

Other factors influencing the length-wise distribution of heat transfer rates include, above all, the geometry of the furnace at various points, which is, of course, the factor determining the degree of re-radiation. Of important influence is also the linear gas velocity past the tubes, which sets the rate of convective heat transfer.

A comparison of the several tubes within the same furnace shows greater uniformity for vertical than for horizontal tubes. This is especially true where the vertical tubes are arranged in a circular pattern around the central luminescent fuel gases. Where parallel flow of several streams is provided, it is frequently desirable to maintain the same transfer relations in the various passages. This can be obtained by selecting flow through tubes situated similarly from a heat transfer point of view. For some types of operation, it is necessary to design for a predetermined rate of heat transfer along the fluid path. In such a case, it may be necessary to provide sectional arrangement for the furnace and to pass tubes through the various sections in parallel flow. Each section is then specially designed to follow the desired heat transfer pattern.

A controlling heat transfer factor, especially in the radiant section of the furnace, is inside the tube. A substantial portion of a horizontal tube's internal volume is taken up by liquid phase which is gradually carried along by the faster-moving vapour phase with which it is in contact. A relatively slow-moving liquid layer may be a major obstacle to efficient heat transfer. This handicap is absent from vertical tubes in which the liquid phase is substantially dispersed in the carrier vapour phase and better heat transfer—as well as less coking tendency—are thus achieved. This introduces considerations which may override savings in initial investment.

In summary, the principal technical factors in proper heater selection are:—

(1) A design which will permit maximum heat transfer per unit area of absorbing surface—within the limits set by processing requirements.

(2) Positioning of heat-absorbing surface in such a manner as will permit maximum uniformity of heat transfer for each square foot of radiant tube surface.

(3) The provision of any flexibility which may be required in absorbing varying amounts of heat in different sections of the oil flow for process reasons.

(4) Arrangement of setting as well as of tubes which will minimise the danger of overheating.

Beyond that, certain characteristics are desirable—but not absolutely necessary—from a maintenance point of view:

(1) Tubes should be of uniform length.
(2) All tubes should be of one or two diameters.
(3) Burners, tubes, and platforms should be arranged for ready accessibility.

From economic considerations, maximum tube length is desirable to minimise the number of costly return fittings. This elimination of many such fittings is a particularly important factor in favour of vertical-tube heaters. It is counterbalanced to some extent by the increased cost of tubular transfer surface in the case of very long tubes.

Mean Temperature Difference

On the other hand, the mean temperature difference between gas and process fluid is greater in horizontal than in vertical tube heater design. Accordingly, where a large temperature rise is to be imparted to the process fluid, horizontal-tube furnaces have

the advantage of permitting operation with smaller heat transfer surfaces.

An important advantage of vertical furnace design, as pointed out by Charles Bliss, rests in the ease with which it lends itself to the use of multiple-stream flow. This is especially important where large throughput would call for impractically large tube diameter in single-passage flow. The geometric simplicity of the cylindrical vertical-tube heater then permits subdivision of the stream into as many parallel paths as may be desired—whereby each path is exposed to substantially identical heating conditions. Bliss points out that, in the case of horizontal pipe stills, the number of readily provided identical passages is limited to four. Beyond that number, additional furnace wall area (for proper re-radiation) is required. The furnace then becomes costly and complex.

This latter factor is not of prime importance if the chemistry of the process does not require a uniform heating pattern. In a mere heating or preheating operation, various streams may often be boosted to different temperature levels, and the blended mixture will have the desired temperature. This contradicts to a certain extent the principle that best use of transfer area is achieved by uniformity of heat transmission. There are, however, numerous cases where simplicity of process, or the demand for flexibility of furnace function may subordinate this general principle to economic demands.

Use of Soil Conditioners

Official U.S. Warning on First Trials

THE U.S. Department of Agriculture has advised farmers, small-holders and gardeners to be careful in their use of the new soil conditioners and to use them only experimentally for the time being.

While some of these chemicals are known to improve the structure of heavy clay soils, it points out, experiments with them are still in an early stage.

In reply to the many inquiries it has received for advice on soil conditioners, the Department issued this statement:

'Purchasers of soil-conditioning chemicals should buy the products only with an experimental point of view at the present time.

'Work so far indicates that these conditioners are most effective on soils with high clay and silt content and are not effective in soils with high sand content.

'Soils which already have good structure naturally will not show great improvement. It is, therefore, suggested that only small quantities be purchased until the grower is convinced by experience that better soil conditions gained from their use are worth the cost involved.

'Several synthetic compounds including such chemicals as acrylates, polyacrylates, polyacrylonitrile compounds, maleic acid derivatives and other materials of various kinds have been shown to be effective in forming and maintaining soil aggregates that resist breakdown by water.

'Rates of application have considerable influence upon the extent of aggregate stabilisation. As a rule, an application at the rate of about 2,000 lb. of active ingredient per acre to the top six inches of the soil has been found to give a near maximum degree of aggregation.

'Dilute solutions and powder of differing formulae would effectively treat correspondingly smaller areas or shallower depths per lb. of material.

'Some manufacturers indicate the nature of the chemical compounds that they use. Others do not. Some of the materials offered for sale are powders with a high percentage of active ingredient.

'Other powders are mixed with inert substances to aid in uniform application to the soil and to prevent caking of the chemical before or during treatment. Other products are sold as water solutions containing a relatively low percentage of active ingredient.

'It has long been known that soil organic matter, manures, composts, peats and similar materials contain substances that bind and stabilise small soil particles into larger, crumb-like particles or aggregates.

'Development of synthetic soil aggregate stabilisers (soil conditioners) is an attempt to prepare chemical substances effective for this purpose. It should be noted that natural organic materials leave beneficial effects in addition to those of forming and stabilising soil aggregates.'—B.U.P.

Pakistani Glass Factories

Two glass factories are being constructed in Karachi, Pakistan. One will have a capacity of 20 tons a day, and the other, a sheet glass unit, will have a capacity of seven to ten million square feet of sheet glass a year.

Chemical Works Safety

Proceedings of The ABCM's Buxton Conference

MANY technical points of great interest were discussed at the Fourth Chemical Works' Safety Conference organised by the Association of British Chemical Manufacturers and held at Buxton from 2-4 May.

Two hundred delegates attended, and the papers and proceedings have now been published and are obtainable from the intelligence officer of the ABCM (7s. 6d., post paid, cash with order).

Dr. L. J. Burrage, General Chemicals Division, Imperial Chemical Industries, Ltd., gave a paper on 'Safety in the Laboratory and on the Plant,' which took the form of an abridged safety handbook with sections dealing separately with laboratory scale hazards and precautions, and those encountered on pilot or full-scale plants

Education Necessary

Emphasis was laid on the need for encouraging and educating staff and workers, for the author considers this essential to satisfactory safety conditions.

After a general introduction, Dr. Burrage discussed team building as a basis for safety, organisation of safety services and methods of instruction. Various hazards common to the chemical industry—fire, explosions, burns and poisoning—were illustrated and protective measures and their effects were detailed.

'Toxic Dusts in Industry' were discussed by J. S. Evans (technical department, Federation of British Industries) and Dr. D. Matheson (Factory Department, Ministry of Labour and National Service) dealt with the 'Relation Between Plant Strength and Dust Explosion Relief.'

The importance of 'Safety in Plant Maintenance' was the subject of a paper by C. A. Beaton (Monsanto Chemicals, Ltd.).

Maintenance, he said, should be considered in the development and design of new projects, as many possible sources of accident could be eliminated at the start. Safety in maintenance was a matter of care and concentration on the task in hand.

Responsibility rested not only on the supervisory staff, who, in initiating the work, were expected to ensure that all foreseeable hazards were anticipated and brought to the particular notice of the worker, and that correct methods were adopted in performing the work, but also on the man doing the job who must follow the instructions given and adopt at all times the precautions provided for his safety.

'Safe Transportation and Storage of Chemicals' was the final paper presented by I. E. Baggs, P. D. Moll and C. W. Richards on behalf of the ABCM panel on the Marking of Containers of Hazardous Chemicals.

Products chiefly referred to in this paper were either packaged chemicals going to another manufacturer for use in process, chemicals sold to intermediate handlers who might repack, re-label, and sell under a different name, or chemicals which might pass through a series of intermediate handlers, but which might be intended for consumption by other industries, the professions, or the general public. The problem of ensuring safe transportation and storage had become increasingly important as the variety of chemicals manufactured had increased.

The intermediate handlers also had a growing problem, and the chemical industry as a whole had a responsibility in this field to ensure that its good reputation in these matters was maintained. The subject was attracting international attention through the International Labour Organisation.

Basic Principles

In this paper the authors were therefore attempting to set forth some basic principles for wording for labels or other markings which they believed, if followed, would assist the safe transportation and storage of the wide range of chemicals which were in day-to-day use. These basic principles were those on which the Association of British Chemical Manufacturers' Panel was now working with a view to evolving a system of labelling chemicals to assist their safe transportation and storage within the confines of the United Kingdom.

Examples of various existing types of label, wall charts and so on, were given, with a list of the chemicals which would form the first batch to be dealt with.

New Photoelectric Absorptiometer

Compactness and Accuracy said to combine

AN entirely new photoelectric absorptiometer (or colorimeter) to be known as the New Biochem Absorptiometer, will shortly be put on the market by Hilger & Watts, Ltd.

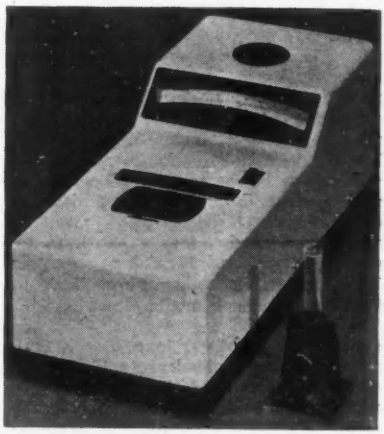
Designed for Routine Use

It is said to be an exceedingly compact instrument whose design makes it specially appropriate to routine use in a chemical laboratory. By embodying in it a sensitive, but very robust, reflecting type of galvanometer and by carefully studying the optical design, the firm claims that they have been able to secure an unusually high degree of accuracy for a single cell type of instrument. So good is its sensitivity that it has been found possible to use filters with a much narrower band-width than are usually employed with such instruments. Eight of these narrow band filters are mounted in a rotatable disc so that the correct one for the job can be instantly selected. A minor, but very useful, point is that the disc is provided with 'flats' on its circumference on which are engraved numbers indicating the approximate transmission peak of the filter actually in use, so that selection of the right filter is instantaneous and independent of code numbers.

The instrument uses a single light source for the measuring system and for the galvanometer spot light; a low voltage lamp run, in one model, from a built-in constant voltage transformer or, in another model, from separate batteries. By reversing the usual reading arrangement of 'spot' galvonometers and using a white matte opaque screen instead of a semi-transparent one the operator always sees the spot clearly without having to move his head to secure the best illumination. The spot illumination is good and is observed without any difficulty in a well-lit room.

Interchangeable Cell Mounts

Two interchangeable cell mounts are available; that fitted to the instrument takes flat sided (Spekker) cells from ¼ cm. to 4 cm. path length and is provided with a combined cover and filling funnel which is invaluable when the fugitive nature of a colour reaction makes it necessary to take readings immediately after the solutions have mixed. An additional cell mount takes cylindrical cells (shortened, selected test-tubes) and embodies an ingenious optical system which largely overcomes the essential drawback of the use of cylindrical cells with photoelectric colorimeters—the fact that such tubes are, in effect lenses with a focal length that varies considerably with the refractive index of the contained solution and is not consistent for different parts of the spectrum. As a consequence, with the usual uncompensated system, there is a variation in the area of the photocell which is illuminated and consequently a source of error that may be more serious than is suspected. Both the cell mounts are made of a polythene plastic which is highly resistant to most solutions and solvents. They are very easily and quickly substituted for one another.



The New Biochem Absorptiometer

The controls, grouped together on the upper panel are both convenient and simple to operate. They consist of a simple shutter for the measuring light, an on-off switch, the filter selector drum and a light control for setting the full scale reading.

Sulphur Prospects Improve

Expert Believes Shortage Nearly Ended

ACCORDING to Mr. Langbourne Williams, Jr., President of Freeport Sulphur Company, the world sulphur shortage is approaching an end. Virtually all sulphur requirements of the United States are already being met, and the outlook for the future is very encouraging in view of nearly 100 new projects in the United States and other 'free world' countries to increase production of sulphur and sulphur minerals, which it is estimated will add more than 4,000,000 tons of sulphur a year by the end of 1955. This amount is equivalent to one-third of the estimated 1951 production of the 'free world' of about 12 million tons of sulphur in all forms.

Production Will Meet Demand

If all the projects come up to expectation, new production should be sufficient to meet all increases in demand by industry or agriculture anticipated up to the end of 1955. The efforts to increase the supply include five Frasch process salt dome projects in Louisiana and Texas, which, with an estimated annual production of 1,370,000 tons of sulphur, are making the largest contribution. The bulk of the production will be under way by the end of 1953. In addition, there are in progress 50 projects to obtain sulphur in the form of brimstone from native deposits, sour natural gas, refinery gases, etc., and 37 projects to obtain sulphur in various other forms such as anhydrite, pyrites and smelter gases.

These projects are expected to add approximately 1,500,000 long tons of sulphur or sulphur equivalent to the annual production capacity of the free world by the end of this year, 1,350,000 tons more by the end of 1953, 250,000 tons more by the end of 1954, and 900,000 tons more by the end of 1955.

The table below shows in more detail how the increases are expected to come into effect.

	1952	*New capacity to be added during year of:* 1953	1954	1955	*Total new capacity by end of* 1955
BRIMSTONE (from Frasch process, other native deposits, sour natural gas, refinery gases, smelter gases and pyrites)	1,268,000	1,001,000	94,000	85,000	2,448,000
SULPHUR IN OTHER FORMS (in pyrites, refinery gases, smelter gases, anhydrite, etc.)	248,000	344,700	163,000	837,000	1,592,700
Free World Grand Total	1,516,000	1,345,700	257,000	922,000	4,040,700

Figures in long tons of sulphur or sulphur equivalent.

To Make Quaternaries

AN associate company of Milton Antiseptic Ltd., Milton Industrial Chemicals Ltd., have commenced manufacture at Riddings, Derbyshire, of a wide range of quaternary ammonium compounds and related chemicals. Initial production will be of compounds most suitable for antiseptic, disinfectant and cosmetic application.

Cetyl trimethyl ammonium chloride will be made commercially available for the first time in this country: this compound is equivalent to the well-known cetyl trimethyl ammonium bromide in bactericidal properties, but has the advantage of greatly increased solubility. Other alkyl trimethyl ammonium chlorides will be available for special uses, some of these products being superior to the cetyl compound in bactericidal activity.

Alkyl dimethyl benzyl ammonium chloride will be available also but is more expensive and less satisfactory than the former products for many purposes. All quaternaries will be manufactured as chloride will be available also, but is more as iodides, nitrates, nitrites, acetates and benzoates can be made on demand.

Output Reduced

OWING to the seasonal falling off in home demand and increased competition in overseas markets a cut of 25 per cent in its production of sulphate of ammonia is announced by Imperial Chemical Industries, Ltd., Billingham-on-Tees. Recession of trade in the plastics and paint industries is also affecting the estimated sales of new organic products such as acetone.

Cuts and re-arrangement of the labour force must not be regarded as panic measures, it was stated by Mr. E. A. Blench, divisional production manager, but as a prudent balancing of production with expected sales.

Metallurgical Section

Published the first Saturday in the month

Metallurgical Section

Progress in Titanium Research

The Search for Cheaper Production Methods

TITANIUM is the fourth most plentiful of the structural metals. Because of its low density, high strength and exceptional resistance to corrosion, it has a vast field of potential applications, and could become the basis of a very large metallurgical industry. It is only through the patient accumulation of knowledge over a long period, however, that titanium and its alloys can fulfil expectations and become industrial materials capable of competing with aluminium, magnesium or steel. One of the foremost requirements is a satisfactory process for large-scale production.

The reduction of titanium ores to metal and its subsequent melting present extremely difficult and complex technical problems. The root of the trouble is that titanium is extremely sensitive to impurities, nearly all of which affect its properties and behaviour. The melting point is some 200°C. above that of steel, and the molten metal attacks all normal refractories. Carbon and fireclay crucibles are decomposed; when melted in sintered alumina the metal takes up aluminium just above its melting point, and fused magnesia is reduced. Buttons of titanium can be prepared by melting the metal rapidly in a lime crucible in a high frequency furnace, but the current has to be switched off as soon as the metal melts or reaction with the lime will occur. Molten titanium will absorb oxygen and nitrogen from the atmosphere, and both these impurities affect the properties of the metal.

Dr. Kroll's Solution

About fifteen years ago Dr. Kroll solved the problem of preparing reasonably pure titanium in sufficient quantities to be useful. Apprehensive of the growth of Nazi Germany, he closed his laboratory in Luxemburg and brought samples of titanium to Britain in 1939. At that period, however, Britain was too preoccupied with rearmament to be actively interested in the long-term prospects of a new metal. Dr. Kroll therefore went to the United States and showed his samples to many firms, but no company would take the risk of developing his process, and ultimately it was the United States Bureau of Mines that gave him the opportunity he sought. In 1946 it was announced that the process had proved successful.

Dr. Allen's Visit

Dr. N. P. Allen, Superintendent of the Metallurgy Division, National Physical Laboratory, visited the United States and Canada last year to study developments in the titanium industry. Though greatly impressed with the progress achieved, he is of the opinion that it will be many years before titanium becomes as familiar a metal as aluminium is today. Titanium sheet will very soon be used, however, in highly specialised applications where its high cost is justified by the technical gains. For instance, there are places round jet engines where stainless steel must be used because the sheet becomes to hot for aluminium to be safe. This difficulty will be overcome by using titanium sheet.

At present titanium costs about forty shillings a pound whereas a pound of aluminium costs one and fourpence and a pound of steel about threepence. When aluminium was first made nearly a century ago, it was sold at £54 a pound. Though the problem of cheap production was solved some seventy years ago, this metal was still in its industrial infancy when the first world war broke out. Many of its most important alloys have been developed during the past thirty years, and it is not very long since aluminium came fully into its own as a structural material. In view of the immense scientific and technological resources at the disposal of modern industry, titanium's progress might well be more rapid than that of its predecessors, aluminium and magnesium, but production on a really substantial scale is still a very long way off.

In the United States the first commercial

production of ductile titanium was in 1948, when output was in the region of 50 lb. per day. Last year E. I. Du Pont de Nemours & Co. announced that their daily rate of production was 1½ tons and was expected to reach 2½ tons this year. A plant under construction at Henderson, Nevada, by the Titanium Metals Corporation of America is scheduled to reach its full capacity of 10 tons daily by the third quarter of the current year. The Americans have thus progressed very rapidly to the stage of constructing plants with a daily capacity ranging from two to twenty tons, but even this greatly increased output is on a very minor scale compared with that of established engineering metals. In British Columbia a plant is under construction at the present time which will have a scheduled production of 500,000 tons of aluminium a year, when full capacity is reached.

Economic Factor

The future of metallic titanium depends on the cheapness with which it can be prepared and on the accuracy with which alloys with desirable properties can be reproduced. Higher outputs should have a favourable effect on manufacturing costs, but the root cause of titanium's high cost is due to the difficulties inherent in existing processes, none of which is really suitable for large-scale production. The reduction and casting processes must be carried out in the complete absence of air, and very special melting techniques must be adopted. The processes used involve heavy capital investment and high operating costs. Throughout the world a search is in progress for alternative processes that will make titanium really cheap.

In the production of metallic titanium Britain is probably three or four years behind the United States, but in view of the importance of this material to the aircraft industry it may be taken for granted that every effort is being made to accelerate developments in this field.

A welcome indication that production has already been started in Britain was afforded by I.C.I.'s display of wrought products at the British Industries Fair this year. This company has devoted much research effort to overcoming the many difficulties associated with the production of metallic titanium. It is now operating the Kroll process of reduction, under licence, and has developed suitable melting furnaces and techniques for the casting of ingots and the subsequent processing of these ingots into various wrought forms. The products shown at the Metals Division stand at Castle Bromwich included hot-rolled titanium rod, extruded titanium tube, hot-rolled titanium sheet, cold-rolled titanium strip, drawn titanium wire, and examples of forged, machined and welded titanium. This was the first public display of the results of rather less than three years' research on titanium and its alloys. Extensive programmes of investigation have been undertaken into economic methods of producing titanium, and on the properties, behaviour and use of the metal. Current production is on the pilot scale, however, and most of the very limited material at present available is required for development purposes.

Doubtless there are other British firms who are also taking an active interest in titanium, but have not yet given the public an insight into what has been achieved. Assuming that outputs of perhaps 50 lb. a day are now in sight, it would appear that producers in this country will soon be faced with the very difficult choice of laying down expensive plants to produce titanium by the present costly methods which might soon become obsolete, or of waiting until the metal can be prepared at very much lower cost. Last year the U.S. Navy Department reported that a process had been worked out which should lower the price of titanium in the States from approximately five to one dollar per pound.

Various research organisations in Britain are endeavouring to develop more efficient methods of production and are also studying the effects of impurities on the constitution and mechanical properties of high-grade titanium and its alloys.

Studying Thermodynamics

Investigators in the Metallurgy Division of the National Physical Laboratory are studying the thermodynamics of certain titanium compounds in order to assess the possibilities of developing cheaper methods of reduction. Experiments on the reduction of titanium tetrachloride with hydrogen have been carried out, but these were abandoned when it became clear that the temperatures necessary for the reduction of the relatively stable chlorides were too high. It is with the metallography of titanium that the Division is mainly concerned. Studies are being made

of the effects of impurities which arise from the various reduction processes, and valuable contributions to metallurgical knowledge have already resulted from this work.

The equipment available at the National Physical Laboratory includes an arc melting apparatus for melting titanium. On a laboratory scale the method of operation is essentially as follows: A button of pure sponge titanium is inserted in a copper cup, which is water-cooled, and an arc is struck with a welding generator between the button and a water-cooled tungsten tipped electrode. When the button has been almost melted through the metal is turned over so that the arc can be directed on to the other side. The process is carried out under about 10 cm. pressure of argon or other completely inert gas and can be employed on a commercial scale, a suitable arrangement for feeding in titanium being incorporated in the apparatus. The arc is struck at the bottom and fed upwards gradually, rotating all the time, until a billet has been produced. During this process the titanium is liable to pick up oxygen and nitrogen. The aggregate content of gases may be as high as 0.5 per cent, depending on the purity of the starting material and the efficiency with which melting has been carried out.

In dealing with titanium metallurgists are handicapped by the limitations of existing knowledge. Titanium dissolves oxygen very readily and it is known that the presence of oxygen, nitrogen or carbon renders it very brittle. Reduction of the present high production costs requires investigation of the precise degree to which such impurities must be removed in order to prevent embrittlement, and the effects of other impurities in varying quantities must also be determined.

Impurities Added

Investigators at the National Physical Laboratory are therefore adding small quantities of impurities to the pure metal and are studying their effects on the alloy and also what changes of structure are obtained from heat treatment at various temperatures. The information thus obtained will lead to better understanding of the factors affecting the efficiency of the reduction process, one of the aims being to find out how closely impurities must be controlled in order to produce alloys which will be useful in practice.

During Dr. Allen's visit to North America appreciation was often expressed of the Division's pioneer work in the determination of oxygen, hydrogen and nitrogen in titanium by the vacuum fusion method. This method involves heating the titanium with iron in graphite crucibles at 1,700-1,800°C. and analysing the evolved gases. Inside a crucible provided with a funnel at the top is located a second crucible containing a suitable quantity of iron. The crucible assembly is inserted in a silica tube which is heated in a high frequency induction furnace, the gases being collected by means of a 4-stage mercury vapour pump. A small sample of the titanium under investigation is placed in a side tube held in a convenient position. The iron is melted and its gas content is entirely extracted, a very high vacuum being produced. The sample in the side tube is then pushed forward and the titanium is dropped into the molten iron. It reacts with the carbon in the crucible to carbon monoxide, which, together with the hydrogen and nitrogen, is collected by means of a toepler pump.

Mixture Analysed

This mixture of gases is analysed and a very accurate determination of the oxygen, hydrogen and nitrogen contents of the sample can be made.

The workers are now examining the effects of oxygen both on pure titanium and on titanium which contains iron, and they may in future study the effects of oxygen on titanium which contains chromium, aluminium, and other additions. This investigation is showing what properties may be expected from titanium containing varying percentages of oxygen and iron. For example, a particular alloy containing 2 per cent Fe has been heated at 1,000°C., 900°C. and 800°C., being quenched in water in each case. The material alters progressively in hardness as the temperature of heat treatment is reduced. The behaviour of another alloy containing 2 per cent oxygen plus 2 per cent iron is entirely different. A tremendous variety of types of structures are being obtained, all of which are associated with different properties. Most of these properties are entirely useless, and the problem is to determine how properties or combinations of properties which are desirable from the engineer's point of view can be obtained and reproduced.

By carrying out this long and complex

investigation the Metallurgy Division of the National Physical Laboratory are now doing for titanium what they did for aluminium during the First World War and for magnesium at a later date. Their work forms part of a series of vast research programmes in Britain, Canada and the United States, which are gradually finding the answers to many questions and laying the foundations of the future titanium era.

Metal Finishing Awards

Three Companies Endow Medals

THE Council of the Institute of Metal Finishing has announced the establishment of the following medals and awards:

Hothersall Memorial Medal.—The Mond Nickel Co., Ltd., have endowed the annual award of a palladium medal (with which will be associated a sum of £50) for an initial period of seven years. The award will be presented to a person of eminence selected by the Council of the Institute who will be invited to deliver a lecture in memory of the late Mr. A. W. Hothersall, to be known as the Hothersall Memorial Lecture.

Johnson Matthey Silver Medal.—Johnson Matthey & Co., Ltd. precious metal processors, have endowed a Silver Medal which will be awarded annually, or at such times as may be decided by the Council, for the best paper presented to the Institute on the deposition of precious metals.

Westinghouse Brake & Signal Co., Ltd. Prize.—Finally, the Westinghouse Brake & Signal Co., Ltd., have endowed an award for the best publication appearing in the Journal of the Institute which, in the opinion of the Publications Committee, shows the most valuable advance in the science or practice of electrochemistry in general, and electrodeposition in particular. The award will amount to £25 annually and will consist largely of a selection of books. There is no restriction respecting subject matter within the limits mentioned above; neither is there any restriction respecting age or nationality of candidates for the award. The award is to be endowed for a period of seven years in the first place and is then to be subject to renewal or revision.

In the case of the Johnson Matthey Silver Medal and the Westinghouse Brake & Signal Co., Ltd. prize, both members and non-members of the Institute are equally eligible, and papers should be submitted direct to the offices of the Institute at 32 Great Ormond Street, London, W.C.1.

Free Market for Lead

AFTER 13 years of official trading the Government has decided that private trading in lead shall be restored as soon as the necessary arrangements can be made by the Ministry of Materials and the trade.

Discussions will begin at once, it was announced by Lord Swinton, Chancellor of the Duchy of Lancaster, in the House of Lords on 28 July. It is hoped that this will enable private imports and dealings in lead to begin on 1 October. The reopening of the London Metal Exchange for transactions in lead will mark another step forward to the goal of free dealings in all non-ferrous metals.

Improvement in lead supplies in the United Kingdom and abroad has no doubt influenced the Ministry's decision, but some importance must be given to the need for the export trade to be able to obtain metal at competitive prices.

The satisfactory position of stocks is shown by the fact that at the end of May, Government holdings of virgin lead in the U.K., together with those afloat or held abroad, amounted to nearly 150,000 tons. During the previous 12 months stocks at home had risen from 25,000 to 105,000 tons, and there has been little reduction since then.

Some reduction from the present official U.K. price of £131 a ton is likely, if only because the selling price on the Continent is about £115 a ton.

Symposium on Powder Metallurgy

The first international symposium of powder metallurgists, attended by nearly 300 scientists from 15 countries, took place recently in Reutte, Tyrol. Discussions centred on labour-saving methods and on the use of newly developed materials in a number of industries, and various other aspects of recent research. United States representatives reported on labour-saving in the sinter process as compared with ordinary methods of melting, forging and machining of metals.

Organo-Metallic Research in Germany

New Olefinic Syntheses via Aluminium Alkyls

AT a meeting of the Max Planck Research Inst., Mulheim/Ruhr, on 14 May, 1952, several interesting papers were read on recent olefine research, including more particularly that of Professor Dr. Karl Ziegler and co-workers (H. G. Gellert, H. Martin, K. Zosel, H. Sauer, K. Meyer, etc). One version of this paper was also read at the meeting of the German Chemical Society at Frankfurt/Main, on 19 May, and is published in *Angew. Chem.* 1952, **64** (12), pp. 323-329, 21 June. Summaries of some of the papers read by co-workers at the Institute meeting (14 May) are also given (*ibid.* 330-331). Professor Ziegler's paper deals with alumino-organic syntheses in the olefine field, describing a new type of reaction for addition of $LiAlH_4$ and AlH_3 to α-olefines. Through these addition products it is possible, too, to reduce the C = C linkage with these hydrides; and aluminium trialkyls can be added to ethylene or α-olefines. At temperatures of about 200°C. the trialkyls act catalytically to polymerise ethylene and other olefines to higher olefines. This has already been studied on a semi-industrial scale. New possibilities are thus opened up in organic synthesis.

It was found that the lithium-aluminium hydride complex at a little over 100°C. readily formed addition products with ethylene and other olefines (e.g., propylene and α-hexene); and this occurred still more easily with aluminium hydride itself. In order to obtain perfectly ether-free products the LiAl tetra-alkyls are treated with aluminium chloride, and in this way the most varied aluminium-alkyls can be obtained.

Olefines Readily Reduced

After briefly discussing the constitution and nature of these reactions in connection with Markownikov's law, the author notes that, contrary to what has been generally believed hitherto, all these olefines can be readily reduced by one or other of the hydrides, and that, in fact, their reducing capabilities are much wider than is generally acknowledged—if the right conditions are observed. Partial reductions are also included.

Considering next the mixed aluminium alkyl hydrides, it is clear that these can be obtained by step-wise additions. Thus the ethyl-aluminium dihydride and di-ethyl-aluminium hydride are first obtained; though these are better obtained from the corresponding chlorides via Li or Na hydride; and the chlorides, in turn, can be obtained in various ways. Special study has been made of the di-alkyl-aluminium hydrides, notable di-ethyl, some properties of which are indicated—as distinct from those of the product obtained by Brokaw and Pease (*J. Am. Chem. Soc.*, 1950, **72**, 3237) similarly but, in the author's view, erroneously named. It is shown, moreover, that the precise rate of addition of this hydride (di-ethyl) to olefines can be determined: those of an end position, for example, are attached 100 times more quickly than those of a middle position.

Different Temperature Ranges

From the foregoing addition reactions to the next stage of metallo-organic synthesis and catalysis is relatively only a short step. In the first place there is a complete parallel between the aluminium-hydrogen and the aluminium-silicon bonds, some consequences of which are exemplified by relevant reactions. One difference is in the respective temperature ranges. Another is that if the AlH_3 molecule is saturated, as in $Al(C_2H_5)_3$, further addition of ethylene is only possible through an aluminium-carbon bond. But this is difficult, and the reaction can be easily stopped at the aluminium tri-ethyl stage. It is thus shown that the further course of the reaction proceeds on purely statistical rules. In other words, before all the ethyl has been built up to butylene, individual butyl groups already begin to form hexylene; before all the hexyls are formed octylenes appear, and so on. So that the end-products are mixtures of aluminium trialkyls. By decomposition with water, the side chains become saturated hydrocarbons, and thus a very convenient method is available for the synthesis of paraffin mixtures that can be easily separated, whether in the even or odd number series. Some earlier work in this field by the author and others is noted, together with possibilities from

other elements or metals in the three first groups of the periodic system. The production of the higher olefines, using aluminium alkyls as catalyst, is also described.

This last type of reaction is essentially an organo-metallic synthesis that may be compared with the Grignard reaction, although it is of more limited application, in the author's view. On the other hand, in it, only carbon double bonds are involved: the metal atom cannot join up with oxygen—and so lose its essential organic valency—but is continuously 'regenerated', via the Al-H group, as an aluminium alkyl. This is a new principle in organic synthesis that should open up a wide vista.

Plant for Dimeric Reactions

On a semi-large scale the relatively simple plant required for dimeric reactions is described. The aluminium alkyl, in this case propyl, together with liquid propylene, in volume ratio of 1 : 3 or 1 : 2, are introduced into an autoclave heated to 200°C. Pressure is controlled by manometers between 180 and 200 atmospheres. The dimer containing dissolved catalyst is drawn off below and flows first through a slightly heated column in which it gives up the small content of unchanged propylene; then through another column heated to 100°C. from which the propylene dimer is drawn off above and aluminium propyl below. The latter, together with residual propylene, is returned to operational cycle. In about 60 minutes, with a conversion of 80-90 per cent, 1 litre of dimer per hour per litre reaction space is produced, or 100 litres in four days—an excellent space-time yield. Catalyst losses are very small. This type of layout can also be used for many other such reactions, including mixed dimerisation of various olefines.

Some corollaries of the foregoing are discussed, e.g., syntheses using stoichiometric amounts of reactants—in principle somewhat similar to the Grignard reaction, though with marked practical differences.

Technical Applications

Finally, the author discusses some aspects of the technical applications of the process, and such questions as: (a) are the aluminium alkyls so readily and easily available as to meet considerably wider and more varied demands, and (b) can the new reaction be adapted on an appreciable scale to technical and industrial purposes? From experience gained during the past year or two the author has no hesitation in answering both questions in the affirmative. As to the first, the case is somewhat similar to that of tetraethyl lead, but instead of the lead-sodium compound ($PbNa_4$), the Al_2Mg_3 binary is used; and there are other methods, too, for production of the Al alkyls.

The affirmative answer to question (b) is of great practical importance in the petroleum products industry, especially in connection with the olefinic products of cracking. The new process provides a very simple transition from ethylene to butadiene *via* dehydrogenation, with high yields. It should also prove extremely valuable in the synthesis of many aromatics of clearly defined structure, of which some examples are given.

To the other papers on the same subject read at the meeting of the Max-Planck Institute, by Professor Ziegler's co-workers, only the briefest reference can here be made. Summaries are given (loc. cit.).

Intermediate Products

H. Martin dealt with intermediate products and partial reactions of the new catalytic method, also preparation and properties of the diethyl-aluminium hydride as prototype of the dialkyl aluminium hydride. He described a simple appartaus (Kontraktometer), in which, if the hydride is mixed with the olefines, the rate of addition or reaction velocity of the hydride to the olefine can be kinetically followed with ease.

K. Zosel described the constitution of some dimeric olefines, e.g., propene and *n*-butene, prepared with aluminium alkyls as catalyst.

A paper on *p*-xylol from butene or ethylene was read by H. Sauer, to exemplify further the production of aromatics (C_n), the separation of which, since *m*-xylol is absent, is extremely simple. It requires merely deep cooling and distillation. Yields are 55 per cent *p*-xylol, 26 per cent *o*-xylol, and 19 per cent ethyl-benzole.

K. Meyer discussed the action of acetylene on the polymerisation of ethylene (by dissolved out radicals), under pressures of 400-500 atmospheres and temperatures of 60-65°C., in the presence of azo-*iso*butyric nitrile as a radical stimulator, with benzole as a neutral solvent. It was found that acetylene was strongly inhibitive.

Welding Research in 1951

B.W.R.A. Issues Its Seventh Annual Report

OUTSTANDING progress in the growth of facilities for welding research is recorded in the seventh annual report of the British Welding Research Association for the year ended 31 March, 1952. The new laboratory building had been completed and the special equipment—including the 100-ton Losenhausen fatigue testing machine—had been installed and was already in operation.

With the support of the Department of Scientific and Industrial Research a special grant was obtained from ECA funds for the purchase of a Kentron hardness testing machine which was being used in the metallurgical laboratories. Complete 'Aircomatic' welding equipment had been obtained on loan from the Ministry of Supply, also for use in the metallurgical laboratories, and a 50-ton Denison tensile testing machine had been added to the equipment of the new fatigue testing laboratory.

The whole cost of this equipment had been met out of current income. That this had been possible was due entirely to the ready response by members to the appeal for extra funds and more particularly to the generous contributions made by trade associations of which the British Constructional Steelwork Association, the British Iron & Steel Federation, the Tank & Industrial Plant Association, the Society of British Aircraft Constructors, the Water-Tube Boilermakers' Association and the Aluminium Development Association deserved special mention. Thanks were also due to the British Shipbuilding Research Association and the British Electricity Authority for their generous financial support, and to the DSIR without the support of which, financial and otherwise, efforts could not have succeeded.

Co-operation Appreciated

No research organisation can do its best work without maintaining close liaison with other bodies and the helpful co-operation which had been extended during the year by other research associations, professional institutions and the universities was warmly appreciated. Of these, special reference must be made to the University of Cambridge and the Institute of Welding. The association continued to take part in the work of the International Institute of Welding.

A Summer School was organised by the association at Ashorne Hill from 25 May to 2 June, 1951. Over 250 students attended and lectures and demonstrations were given on all aspects of welding. The success of this experiment was such that a similar school to be held at Ashorne Hill was arranged for the summer of 1952.

Welding Productivity Team

As recorded in the last annual report, Dr. H. G. Taylor was appointed leader of the specialist team chosen by the Anglo-American Council on Productivity to investigate and report on welding in the U.S.A. The report was issued in August, 1951, and the team had given many lectures, in which Dr. Taylor had taken part, at meetings organised throughout the country by the professional engineering institutions and others. It was felt that the knowledge and experience thus made available to engineers in this country had benefited both members and industry generally.

Ordinary membership of the association was now 235 and Associate membership 19, compared with 214 and 18 at the time of the last report.

Requests for technical assistance during the year numbered 160 of which 34 called for investigation in the laboratories. In addition, 113 inquiries, which were of sufficient importance to be recorded, were answered by telephone. Visits to members numbered 217, and 115 visits were paid to non-members with a view to increasing membership.

It was felt that both members and the association would gain if senior research workers were brought into closer contact with members' problems, and it had therefore been arranged that whenever possible these would be investigated on the spot by the members of the research staff specialising in the particular field in which the difficulty had arisen.

During the year Dr. Nicol Gross resigned his assistant directorship to take up an important appointment in South Africa. The

present staff numbered 76 with four vacancies to be filled.

Income for the year amounted to £88,624 which was the highest figure reached since the inception of the association. Current expenditure amounted to £70,326 to which had to be added transfers of £13,716 to Fatigue Laboratory Building and Special Equipment Fund Account and £1,000 to reserve for replacement of plant. The surplus of £3,582 had been added to the accumulated fund.

Deaths Accidental

Inquest Held on Gassed Workmen

HOW an accidental mixing of substances at a tin smelting works produced a gas which caused the death of two workmen, was described at a Bootle inquest on 21 July. A verdict of misadventure was returned on James Joseph Alexander Ellison, aged 23, of Kent Street, Bootle, and Stephen Jones, aged 33, of Tuscan Street, Seaforth, employees of Messrs. Williams Harvey Ltd., Mellanear Works, Hawthorne Road, Bootle. The men died in hospital after inhaling an arsenical gas at their work on 20 June.

Mr. Ronald William Scarlett, works manager, said he was told that the two men had been taken to the first-aid room complaining of weakness and headaches after mixing charges for the calcining furnaces. He found they had been shovelling roasted arsenical dross—residue from the refining process—into the furnace charge hoppers. This material had been brought by truck from the refinery by an experienced employee, Albert Bailey.

When loading the arsenical dross this man loaded with it some moist material which was on the floor nearby and which he thought was flue dust. The moist material, which contained tin, had been taken from the gutters of a building opposite by contractors' workmen who were repairing the roof. It was to have been added to the smelting furnace charges. Dross from the alloy preparation was responsible for the accident, by getting mixed with the damp gutter cleanings. The solution was to prepare the alloy in a furnace used solely for this purpose. Another furnace was being installed at the works.

Bailey said he loaded the material on his own initiative. If he had known any of the material was damp he would not have put it in the truck. He knew that as long as the substance was dry it was safe.

Canadian Aluminium Projects

PROGRESS in constructional work being carried out by Aluminium, Ltd., was given by its chairman, Mr. N. V. Davis, at a recent meeting in Montreal.

Work generally was up to schedule. Of the new hydro-electric power facilities, which accounted for more than half the total outlay, the first of 10 new generating units on the Peribonka river, in the Saguenay district, was expected to start in August.

Hydraulic work and a 10-mile tunnel through the mountains were well under way in the British Columbia project.

Production had begun at a new smelter at Isle Maligne, Quebec, and would shortly be operating at a capacity of 50,000 tons annually.

After eight years of exploration and development, the first stages of bauxite mining and alumina manufacture were scheduled to begin production in September.

Electroplating Standard

THE British Standards Institution has issued a further publication in the series which is being prepared covering electroplated coatings of various metals.

The present document (B.S. 1872:1952) deals with electroplated coatings of tin. It provides for coating of this metal on fabricated articles of iron, steel, copper and copper alloys and covers five classes of coating according to the use to which the coating is to be put. It also provides details of samplings, finish, solderability, thickness, adhesion and heat treatment, together with the necessary methods of test. Copies may be obtained from the British Standards Institution, Sales Branch, 24 Victoria Street, London, S.W.1, price 2s. 6d.

American Development

Representatives of American Metal Exports Incorporated, of New York, announced in Singapore recently that they intend to invest £2,000,000 in developing iron-ore deposits at Tewangang, in Kelantan, which they acquired from Chinese interests last year. They said they intended to ship the ore to Japan.

West German Chemical Sales

Trade Recession May be Spreading

FALLING imports and declining bank advances to industry are some of the symptoms which suggest that the trade recession noticeable in Western Germany since the end of 1951 is, if anything, spreading, but chemical manufacturers are generally maintaining their domestic sales while foreign competition has forced them to reduce export prices in various fields. The fall in the world commodity markets has necessitated at least one drastic revision of chemical projects started when raw material prices were rising fast. The buna rubber production at Marl has been reduced to a monthly rate of 300-350 tons, compared with 500 tons when production was resumed, and, despite the subsidy paid to users of home-produced synthetic rubber out of the levy on imported natural rubber, it is not now thought likely that the expansion plans announced last year will be carried out.

A synthetic phenol plant is to be set up at Gladbeck-Zweckel by Phenol-Chemie GmbH, a new company in which the Hibernia-Scholven group is co-operating with Rütgers and Harpener Bergbau. Plant for an annual output of 6,000 tons will be set up at first, but the present plans provide for an ultimate capacity of 12,000 tons a year. The new plant will thus be able to produce more phenol than is available at present from all sources—coal-tar as well as synthesis. The process to be employed by Phenol-Chemie goes back to the work of Hock and associates at the Mining Academy of Clausthal before and during the war, but will incorporate improvements evolved since in other countries. While German synthetic phenol production before the war was based largely on imported benzole supplied to the chemical industry free of duty and hydrocarbons tax, the new plant will probably rely on domestic raw materials. The bulk of the output will be taken up by German producers of plastics, softeners, insecticides, pharmaceuticals and—to a growing extent—chemical fibres.

One State Attracts Industry

No less than 45 per cent of West Germany's chemical production originates in one of the seven States into which the Federal Republic is now divided, in North Rhine-Westphalia. This industrial region, favoured by ample supplies of coal, lignite and electric power, as well as cheap transport and skilled labour, continues to attract new chemical manufactures, especially those transferred from the Soviet zone by firms who have moved their domicile to the Federal Republic.

Considerable attention is being given to means of making colliery operations more profitable by combining coal production with coking and by-product processes. Several of the leading coal mining undertakings have taken active steps to extend their chemical activities, and at least one of them, Rheinpreussen AG für Bergbau und Chemie, is preparing to develop the latter to the full. The company which intends to erect another 50 coke ovens at a total cost of 10,000,000 marks, disposes of its industrial alcohol output without difficulty. It produces a number of plastic materials, intermediates for washing and wetting agents for the textile and leather industry and pharmaceuticals.

Dyestuffs Hit

During the early part of this year the German dyestuffs production was almost one-third below the 1951 level, and exports which had begun to decline in the second half of last year have continued to fall since. The slump in exports is partly due to the general falling-off of demand after the Korea boom, but there were several aggravating circumstances affecting German exporters in particular. The 1951 export boom had been helped by the inability of other exporters to meet the whole demand of their foreign customers and by favourable trade agreements. The erection of new dyestuffs factories in India, Brazil and other countries has hit German dyestuffs exporters especially hard because they based great hopes on permanently regaining these overseas markets. Nevertheless leaders of the German dyestuffs industry expect that they will be able to maintain their position as leading exporters, which they regained last year, and to contribute at least one-third to the total supply of organic dyestuffs entering international trade.

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Glass-Fibre Plastics

The Council of the British Plastics Federation has called an informal meeting at its offices at 47 Piccadilly, London, W.1, at 2.30 p.m. on 14 August, to discuss the machinery which might be set up within the Federation to cater for firms interested in reinforced low-pressure glass-fibre plastics. Non-member firms interested are asked to communicate with the Federation director.

Mesityl Oxide Reduced

A reduction in the price of mesityl oxide by £10 per ton has recently been made by Shell Chemicals Limited. The price per ton for the 10-ton rate is now £216.

Science in Industry

A reduction in the price of mesityl oxide Scientific Committee was received by Lord Woolton, Lord President of the Council, on Monday, 28 July. Representations, based largely on the report of the Department of Scientific and Industrial Research for 1950-51 (THE CHEMICAL AGE, **66**, 673), were made about the need for industry to make greater use of scientific methods as an aid to productivity; the shortage of scientific manpower; and the importance of more generous financial support of the DSIR. The Lord President promised to consider carefully the points raised.

Refineries Nuisance

Stanlow Rural Council are to approach the Ellesmere Port and Runcorn Urban Councils, the Chester and Northwich Rural Councils, with the object of calling a conference to consider the question of what action to take to abate a nuisance alleged to emanate from the oil refineries at Stanlow.

Fire-Proof Belting

By early next year it is hoped that a quarter of the total production of conveyor belting for British coal mines will be polyvinyl chloride. The 100 per cent use of PVC belting in the pits at the earliest possible moment is the aim of the Coal Board, since it was emphasised by Sir Andrew Bryan, in his report on the Cresswell Colliery disaster, that fire risks are greatly reduced when this material is used instead of rubber.

Fertiliser Costs

The increase in costs per ton of fertilisers during the past three years was approximately 69 per cent according to a written answer by Sir T. Dugdale, Minister of Agriculture, in the House of Commons on 25 July. In 1951-52 the estimated quantity of fertilisers bought in the U.K. was 3,182,000 tons at a cost to the farmer of £54,689,000, which included a sum of £8,000,000 received by the farmer as a direct subsidy on phosphatic fertilisers.

Steel Development Plan

A new melting shop at the Hawarden Bridge steelworks of John Summers & Sons, Ltd., near Chester, will begin production on 17 August. The new melting shop, with its eight furnaces with a capacity of 15,000 tons a week, is part of a £17,000,000 development programme now nearing completion. In October, the first of two batteries, each of 44 coke ovens, will come into production. A new blast furnace, claimed to be the largest outside the U.S.A., will be started before the end of the year.

Laboratory Fire

A serious fire, believed to have been caused by a cable fault, gutted the basic production department of Crookes Pharmaceutical Laboratories at Park Royal, London, on 17 July. Pharmaceutical machinery including filling equipment, vats, tanks, and basins were damaged, but the ACTH plant and large stocks of halibut oil stored elsewhere escaped harm. Mr. G. E. Watson, general manager, stated that, thanks to duplication of departments, the supplies position generally would not be affected.

New Laboratories on View

Acclaimed by Sir William Larke as 'the finest laboratories attached to any steel works in the world,' the new laboratories of the United Steel Companies, Ltd., were open for inspection on 24 July. The new laboratories have been given the name of Swinden in honour of the late Dr. Thomas Swinden, under whose direction the original research department at Stocksbridge rapidly established a reputation in chemistry, metallurgy and refractories.

• OVERSEAS •

Oil Project in India

As a result of an aerial survey of West Bengal to discover new sources of oil, the Standard Vacuum Oil Company is to ask for further prospecting rights, so that a more intensified and detailed investigation of the oil-bearing basin can be undertaken by the company.

Australian Rubber Venture

A new company, P. B. Cow (Australia) Pty., has been registered with an authorised capital of £250,000 to be subscribed jointly by Leggett Products, Pty., of Melbourne, and P. B. Cow & Co., Ltd., of London. The object is to manufacture and market in Australia specialised rubber products made by the English company and its subsidiaries.

Back to Pre-war Sales

Sales of the German chemical company, Ruetgerswerke AG. of Frankfurt, returned to their pre-war level last year, it was stated recently at the company's annual general meeting. The firm, which fared badly during and after the war, has steadily improved its sales since 1949. As a major producer of tar chemicals, the company found that demand dropped last year for anthracene, naphthalene and phenol. It was always possible to meet orders for these chemicals fully.—B.U.P.

Norwegian Research Centre

A research centre for Norwegian industry is to be set up at Gaustad near Oslo. Robert Major, Director of the Industrial and Scientific Research Council, whose activities are largely financed from football pool profits, states that the first stage of the construction programme involves the erection of several buildings for the Central Institute of Industrial Research with a floor space of 11,000 square metres. The cost of this construction stage is put at £600,000. The Institute will provide accommodation for a number of specialised institutes in such spheres as building research, geo-technics, seaweed utilisation, textile research, and X-ray control. Another large building to be erected at Gaustad will house the paper industry's research institute with a floor space of 4,000 square metres.

Canada Makes Explosives

Western Canada's first commercial high explosives plant is now in production. The plant will provide sufficient commercial explosives for all Western Canada's industries for some years to come. The plant was built at Calgary because nitrogen from the ammonia produced by Consolidated Mining and Smelting Company is available.

Royal Dutch Refinery Expansion

Refinery capacity of the Bataafsche Petroleum Company at Pernis, near Rotherham (the operating company of the Royal Dutch), is to be increased from 6,000,000 to 9,000,000 tons by the construction of a fourth distilling unit with a capacity of 10,000 tons a day. The chemical industries of the company are also to be enlarged, with the asphalt and lubricating oil factories.

Local Study Courses a Success

A successful experiment in advanced study courses was carried out in the autumn of 1951 and spring of 1952 by the Charleston, West Virginia section of the American Institute of Chemical Engineers. By charging $6.00 for a course of eight lectures the group was able to pay lecture fees and travel expenses of experts on distillation and heat transfer from all parts of the U.S.A. Further courses now being considered include chemical thermodynamics, economics and kinetics, and technical writing.

Canadian Magnesium Output

Production of magnesium at the Arvida plant of Aluminium Company of Canada is to be increased by 1,000 tons a year. The programme will cost about $2,000,000 and will raise the annual output of the light metal from 3,000 to 4,000 tons. The move is the result of an agreement between the company and the British Government giving the latter first call on 2,640 tons annually for 20 years.

CO for Jamaica

The carbon dioxide plant of the Sugar Manufacturers Association (of Jamaica) Ltd., is now in full production, and is supplying the island's requirements totalling about 350,000 lb. per annum.

PERSONAL

MR. B. A. V. PROBERT, of Ecclesfield, South Yorkshire, formerly on the chemical trades sales staff of Newton Chambers and Co., Thorncliffe, has been appointed general manager of the British Chemotheutic Products, Ltd., and associated companies, of Bradford and Canada.

DR. J. S. WEBB, Ph.D., D.I.C., A.R.S.M., B.Sc., of the Royal School of Mines, London, left London by air on 29 July for a six weeks' survey of the latest methods of geochemical prospecting in the United States. Dr. Webb, who will assess the value of geochemical prospecting methods now in use in the United States, will join DR. H. E. HAWKES of the United States Geological Survey in Denver, Colorado, and together they will visit universities, mining organisations and mining projects. Dollar costs of the trip, which comes under the Technical Assistance Programme of the Mutual Security Act, are expected to come to $1,100. They will be met by the U.S. Mutual Security Agency.

DR. A. C. WAINE, director of research of the Triplex Safety Glass Co., Ltd., of King's Norton, Birmingham and Willesden, N.W., has been appointed chairman of the Society of Glass Technology (Midland Section).

MR. A. ROBERT JENKINS, J.P., A.I.Mech.E., deputy managing director of Robert Jenkins & Co. Ltd., of Rotherham, was installed as president of the Institute of Welding for 1952/53 at the annual general meeting of the Institute on 22 July.

Mr. Jenkins, who was educated as a mechanical engineer at Sheffield University, entered the family business at Rotherham in 1931 as Plant Maintenance Engineer. Shortly afterwards he took charge of the Works Progress Department, became works manager and a director of the company in 1934 and in 1946, as works director, became responsible for the whole of the production and technical side of the works. He has travelled widely, visiting factories in Sweden, Germany and the U.S.A. and was a member of the Specialist Productivity Team on Welding, which visited the U.S.A. in 1950.

The new vice-president of the Institute is MR. H. B. FERGUSSON, M.I.N.A., M.I.Mech.E., M.E.I.Canada, who for fifteen years has been a director of G. A. Harvey & Co. (London), Ltd.

At the annual general meeting of the British Standards Institution, held on 23 July, it was announced that the General Council had elected MR. JOHN RYAN, C.B.E., M.C., as chairman to succeed SIR ROGER DUNCALFE, who had completed his three years' term of office. The RT. HON. VISCOUNT WAVERLEY, P.C., G.C.B., G.C.S.I., G.C.I.E., F.R.S., was re-elected president for the third year and Sir Roger Duncalfe was elected vice-president.

Sir Roger's term as chairman coincided with B.S.I's period of most rapid growth, and his acceptance of the vice-presidency reflects his continuing and active interest in the Institution's work. As chairman of British Glues and Chemicals Ltd., he is widely known in industry.

Mr. John Ryan is vice-chairman of the Metal Box Co., Ltd.

Obituary

Mr. Lammot Du Pont

MR. LAMMOT DU PONT, who died on Thursday, 24 July, at New London, Connecticut, was the youngest of three brothers who developed the great chemical concern of E. I. Du Pont de Nemours during the First World War.

The modern foundations of the Du Pont fortunes were laid by Alfred Du Pont in 1902 with a big powder trust. Later, however, he was ousted by his cousins, the brothers Pierre, Lammot, and Irénée. Lammot, who was the real driving force, was president of the company from 1926 to 1940 and chairman of the board from 1940 to 1948.

He was one of nine defendants in an anti-trust suit brought by the United States Government in 1944 against four corporations and five individuals. In September, 1951, it was ruled that the four firms, which included I.C.I., were engaged in 'a combination and conspiracy in restraint of trade and commerce.'

The Chemist's Bookshelf

AN ENGINEER'S APPROACH TO CORROSION. By C. F. Trigg. Sir Isaac Pitman & Sons, Ltd., London. 1952. Pp. IX + 133. 15s.

In the introductory chapter of this book the author outlines broad classifications of corrosion and emphasises its importance by reference to costs involved in providing adequate protection against corrosion.

The mechanism of corrosion is treated in Chapter II, under the headings of electro-chemical corrosion, atmospheric corrosion, and brief notes on intergranular corrosion, stress corrosion, corrosion fatigue, crevice corrosion, and fretting corrosion. The text on atmospheric corrosion is supported by illustrations of experimental data, but electro-chemical corrosion is only dealt with theoretically.

Corrosion under special conditions forms the subject of the third chapter. Items discussed under the heading of 'special conditions' are boiler deterioration, internal combustion engine corrosion, corrosion of lead, corrosion of steel in concrete, soil corrosion and soil corrosion testing.

Effects of corrosion are considered in Chapter IV with particular reference to stress corrosion and corrosion fatigue, the combined effects of stress and corrosion being illustrated by calculations. In addition, the author briefly discusses the effect of corrosion on motor car chassis, reinforced concrete, steel and copper embedded in masonry, water pipes in clay sub-soils, electrical equipment, heat exchange equipment, and fuel tanks.

Prevention of corrosion is featured in Chapter V by reference to the corrosion resistance of various metals and their alloys, and an indication of the duties for which they can be used in the engineering field. The metals covered are copper and its alloys, aluminium alloys, magnesium alloys, stellite, cast iron, steels, chromium and nickel alloys, nickel and its alloys, and non-metallic materials such as plastics, glass, rubber and carbon. Design requirements to minimise corrosion effects are summarised.

Preparation of metallic surfaces for corrosion-proofing is discussed in Chapter VI. The processes covered are those involving polishing by abrasive methods, the treatment of metals for metal spraying, descaling, and cleaning. Production of passive films on metal surfaces is also discussed in brief.

Chapter VII deals with permanent protective treatments. Metallic coatings are classified into two types, the first consisting of coatings cathodic to the metal it has to protect, and the other class consisting of coatings anodic to the metal. Cathodic coatings are liable to be lifted locally by products of corrosion, whereas anodic coatings tend to be preferentially corroded with respect to the base metal.

Electro-deposition, hot dipping, cementation, metal spraying, cladding, and use of vitreous enamel coatings are described with reference to specific examples.

In the final chapter the author discusses temporary anti-corrosive treatments. These include various oil, grease or resin based preventives for use under different types of atmospheric conditions, and paints. Temporary action to be taken where corrosion comes under the heading of the 'special conditions' mentioned in Chapter III is also briefly discussed.

The book is well written and easy to follow, practical examples being cited wherever possible. It does not deal with metals for highly corrosive fluids and atmospheres, and as a consequence will be primarily of use to the engineer rather than the industrial chemist or chemical engineer.—E.J.C.

ANNUAL REVIEW OF NUCLEAR SCIENCE, Vol. I. Annual Reviews Inc., Stanford, Calif., U.S.A. Distributed by H. K. Lewis & Co., Ltd., London. 1952. Pp. x + 645. 48s.

The field of nuclear science has grown so rapidly over the past ten years and is now so extensive that there is every justification for

some sort of review volume which will present, in the same fashion as the existing volumes of annual reports in various sciences, a digest of progress over each successive year. The Committee of Nuclear Science of the National Research Council of the National Academy of Sciences decided, in 1950, to sponsor such a project, and the present volume provides a background in a number of the more important branches of nuclear science, together with an account of outstanding developments during the year 1950. The volume covering 1951 is in course of preparation, and a provisional table of contents has been announced.

In this volume the individual papers deal with a range of the more important branches of nuclear work, from purely theoretical topics such as the nature of cosmic rays and the theory of nuclear structure to the application of isotopes to biochemical, medical and agricultural problems. Of particular interest to chemists will be the sections dealing with the chemistry of the 'actinide' elements, the chemical separation of stable isotopes, applications of nuclear chemistry to analysis, and progress in metallurgy.

All of the papers (26 in all) are thoroughly documented. This annual review will undoubtedly fulfil a most useful function for those who are not primarily concerned with nuclear work but whose work may be touched by some of its ramifications, in addition to those whose main work lies within this relatively new branch of science.—W.

HANDBUCH DER PRAPARATIVEN ANORGANISCHE CHEMIE. Edited by Georg Brauer. Ferdinand Enke Verlag, Stuttgart. Part III, 1951. Pp. 160, Figs. 35. Part IV, 1952: Pp. 160, Figs. 30. Part V, 1952: Pp. 160, Figs. 23. Each Dm. 21.

The earlier parts of this work have already been reviewed (Part I, THE CHEMICAL AGE, 1952, **66**, 31. Part II, 1952, **66**, 247) and it is not necessary here to refer further to the general layout of the complete work or to the general excellence of the volumes, other than to confirm that the high standard of presentation of material shown in the first two parts is continued in these three newer volumes, and the favourable comments made previously are fully justified by these volumes also. All that is required here, then, is to indicate the topics covered by each of the volumes.

In Part III the section on selenium is continued, and deals with syntheses for 17 selenium compounds. Section 7 concludes with 19 methods for tellurium and its compounds. Section 8, dealing with nitrogen and its compounds, presents methods for pure nitrogen and for over 40 nitrogent compounds. Section 9, which deals with phosphorus and its compounds, comprises over 50 methods. Section 10, arsenic, antimony and bismuth, is made up of 12 methods for arsenic and its compounds, 15 methods for antimony and its compounds, and 14 methods for bismuth and its compounds.

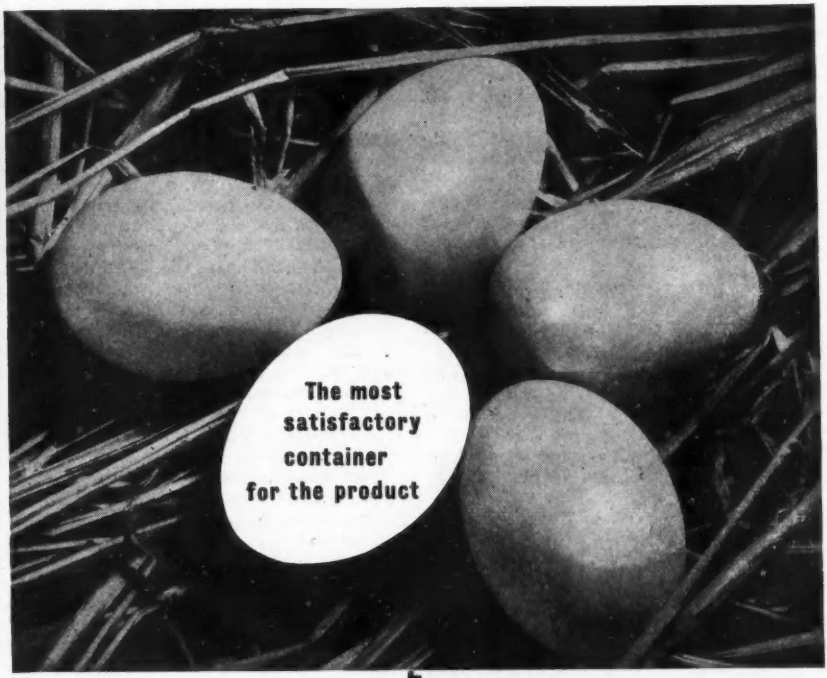
Part IV continues with carbon, section 11, the first few pages of which appear in Part III. There is a selection of methods for the various forms of elemental carbon, a section on graphitic compounds, and a section on gaseous and liquid inorganic carbon compounds and miscellaneous compounds comprising about 20 methods. Section 12 presents about 25 methods for silicon and its compounds, and 13 methods for germanium and its compounds. In section 13 there are 22 methods for tin and its compounds and 18 methods for lead and its compounds. In section 14 boron is allotted over 30 methods, and in section 15 aluminium has about 25 methods. Gallium (28 methods), indium (21 methods) and thallium (31 methods) are dealt with in section 16.

Volume V begins in the middle of the gallium section. It continues with the alkaline earth elements including beryllium (14 methods), magnesium (14 methods), and calcium, strontium and barium (34 methods). In section 18 (the alkali metals) methods are given for the extraction of lithium, rubidium and caesium from their ores, for the preparation and handling of pure alkali metals, and for the preparation of alkali metal compounds not included under other elements. Section 19 includes copper (29 methods), silver (22 methods) and gold (17 methods). This volume concludes with 14 methods for zinc, forming the first part of section 20 (zinc, cadmium and mercury).

It is clear that the set of volumes forms a significant and indispensable addition to inorganic chemistry.—C.L.W.

Offices Transferred

On Saturday, 19 July, the offices of the Technical Equipment Company were moved to 2 Fitzwilliam Place, Dublin.



Long before the 'chicken versus egg' controversy had hatched itself, nature found a difficult problem on her hands . . . how to protect the delicate interior of an egg from a host of exterior influences. The solution that she found is a classic example of good design — a container perfectly matched to its contents. We, too, have produced many equally satisfactory metal containers in the last 83 years. Half ounce tins to fifty gallon drums are our standard range, as well as other numerous sizes and types of containers in common use. New specifications are also evolved frequently for containers to fulfil special requirements. If you are planning to introduce new lines or to re-introduce old ones in more attractive form, the long experience of Reads of Liverpool is at your service.

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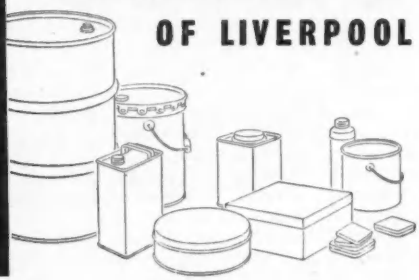

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Publications & Announcements

ALUMINIUM surface treatment and colouring is the subject of *Ciba Review*, No. 92, published by Ciba, Ltd., Basle, Switzerland. After a brief summary of the historical aspects of the colouring of metals generally, the author, Walter W. G. Hübner, deals specifically with aluminium, describing its extraction and manufacture, processes in use for its anodic surface treatment, and various methods of colouring.

* * *

FROM now until the end of September is the season when furniture beetles emerge to deposit their eggs in cracks and crevices on the surface of wood. When the eggs hatch, the grub may bore into the wood for as long as two to three years. The wood should

The new plastic timber fluid injector

be treated with timber fluid, but where the attack is severe it is desirable to inject fluid into the flight holes. For this purpose a new injector to give deep penetration has now been marketed by Rentokil, Ltd. The new Rentokil Junior (Squeezer) injector has a flexible plastic bottle which allows the operator complete control over the jet.

* * *

CHEMICAL and allied trades are well represented in the 1951-1952 List of Members published by the National Union of Manufacturers. In the classified section manufacturers and producers are set out under the following headings: chemical apparatus; chemical closets; chemical compounds; chemical plant; chemicals; chemicals for ceramics, glazed brick, pottery, vitreous-enamels, etc.; chemicals for electro-plating and metal colouring; chemicals, fine and technical; chemicals for leather trade; chemicals, pharmaceutical; chemicals and process for the treatment of metals; chemicals (research work); chemicals, textile; chemicals for water treatment, chemicals from wood; and chemists, consulting and analytical. Chemical engineers are included among the sub-divisions of engineers. The list also includes plastics, plasticisers, extrusion machines; paints, oils and varnishes; petroleum and its by-products; non-ferrous metals; metallurgy equipment; glassware industrial, laboratory and scientific; instruments, insecticides, disinfectants; cooling towers, autoclaves, etc. Member names are also given alphabetically (with their products), and the constitution and policy of the NUM forms a suitable introduction to a useful reference work.

* * *

A DECADE of historical engineering developments in fluid catalytic cracking from the first units at Baton Rouge (La.) to the most modern Orthoflow converters are discussed in the current issue of *The Kellogg-gram* (No. 1, 1952), just published by The M. W. Kellogg Company, refinery and chemical plant engineer-contractors, of New York City. Beyond the actual single-vessel design feature of the Orthoflow converter, a Kellogg development, one of the most important improvements lies in the straight-line flow of the catalyst transportation system. Even the most carefully designed fluid crackers of the more familiar side-by-side type had a maintenance problem at the bends in the catalyst carrier lines. Straight-line transmission reduces the erosion that naturally occurs as the fine particles of fluidised catalyst move at high speed through large pipes between the reactor and regenerator of a unit.

* * *

TWO new publications issued by Redfern's Rubber Works Ltd. are concerned with the firm's rubber and ebonite products and their extruded sections in natural and synthetic rubber. The resistance to chemical action of the rubber and ebonite made by the company is exemplified in the first by tables giving the behaviour of the two materials in contact with various corrosive media at different temperatures. The pamphlet on extruded sections gives examples of shapes that have been extruded by the company—and very various these are. It also gives details of fabricated parts.

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary but such total may have been reduced.)

PHOTO-CHEMICAL CO., LTD., London, W.C. (M., 1/8/52.) 30 June. £2,000 debenture, to Associated British-Pathé, Ltd.; general charge. *Nil. 28 December 1951.

BALDWIN CHEMICAL SALES LTD., Ware. (M.S., 1/8/52.) Satisfaction 8 July, of debentures registered 15 August, 1950, to the extent of £1,500.

Increases of Capital

The following increases in capital have been announced:—HERCULES POWDER CO., LTD., from £260,000 to £342,000; IMPERIAL CHEMICAL INDUSTRIES (TURKEY), LTD., from £180,000 to £280,000; ISOTOPE DEVELOPMENTS, LTD., from £50,000 to £99,500.

New Registration

Gallwey Chemical Co., Ltd.

Private company. (509,971). Capital £2,000. Manufacturers of chemicals. Director: G. Gobert. Solicitor: S. S. Leven, 17 Surrey Street, W.C.2.

Company News

A.P.V. Company, Ltd.

Consistent and satisfactory progress, despite the difficulty of obtaining some raw materials, was reported by the chairman, Dr. Richard J. S. Seligman, in his statement at the 42nd ordinary annual general meeting of the A.P.V. Company, Ltd., held in London on 23 July. All eight associated and subsidiary companies worked profitably in spite of a number of problems, some of which had increased since the end of the year. In India progress had been slightly slower than anticipated but the work for the fertiliser plant at Sindri had been completed. Shortage of skilled labour and import restrictions had to be overcome in Australia. An arrangement had been entered into with the Cooper Alloy Company of New Jersey, U.S.A., to produce and sell its products in this country and also export them overseas, and also for the regular exchange of technical and commercial information. First stage of the transfer to the new factory at Crawley, Sussex, had been completed. Group trading profit for the year ended 31 December, 1951, was £719,030. Total assets amounted to over £5,000,000.

Coalite & Chemical Products, Ltd.

The market for its chemical products in the year ended 31 March, 1952, had been particularly good, said Commander Colin Buist, chairman, in his statement at the 35th annual general meeting of Coalite and Chemical Products, Limited, held in London on 23 July. Much valuable work had been done, production methods improved, and a number of new chemicals isolated. Substantial progress from a steady development of manufacturing capacity and techniques was also recorded. Net profits of the group amounted to £265,552 (£181,370). A final dividend of 5 per cent (3 per cent) was recommended, making with the interim dividend of 3 per cent (unchanged) a total of 8 per cent (6 per cent). Three months of the current year had now passed and it was evident that the demand for chemicals was falling, particularly in overseas markets, but the future could be met with confidence. The death was recorded with regret of Mr. C. H. Parker, F.R.S., F.C.S., who had been associated with the company since its inception and was a pioneer in the low temperature carbonisation industry.

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive, or a woman aged 18-59 inclusive, unless he or she, or the employment, is excepted from the provisions of the Notifications of Vacancies Order, 1952.

APPLICATIONS are invited by the **MINISTRY OF SUPPLY** from **CHEMISTS AND CHEMICAL ENGINEERS** for the following appointments in the grade of **SENIOR SCIENTIFIC OFFICER** at London Headquarters for work concerned with Guided Weapons. (1) To sponsor the development and exploitation of new materials, structures, and technical development for engineering processes. Experience of Plastics and a knowledge of Metallurgy is desirable. (Ref. F.519/52A.) (2) To assess the relative performance of different propellants and warheads under service conditions and to progress and assist development work on them. Some knowledge of Mathematics and some experience of explosives or propellants is desirable. (Ref. F.520/52A.) Candidates must be at least 26 years of age, and must have a 1st or 2nd Class Honours Degree or equivalent in Chemistry or Chemical Engineering, followed by at least three years' research experience. Salary will be assessed according to qualifications, experience, etc. within the inclusive range £812-£1,022 per annum (male). Rates for women somewhat lower. The posts are unestablished but carry F.S.S.U. benefits. Application forms are obtainable from Ministry of Labour and National Service, Technical and Scientific Register (K), Almack House, 26 King Street, London, S.W.1, quoting appropriate reference number.

BRITISH TAR PRODUCTS LIMITED, CADISHEAD, NR. MANCHESTER, require an **ASSISTANT CHIEF CHEMIST,** aged about 30-35, with University Degree or equivalent. Previous experience in the industry desirable. The post is permanent (with Pension Scheme) and involves control of the Works Laboratory, initially under the Chief Chemist, with prospect of early advancement. Opportunities for development and research.

CHEMICAL ENGINEERS for Process Design and/or Development Work are required by **THE BAHREIN PETROLEUM COMPANY, LTD.** Degree or Chartered applicants only considered, who must have had a minimum of three years' experience in this type of work. Salary in accordance with qualifications and experience, on successive two-year agreements with paid local and home leaves. Board, air-conditioned living accommodation and medical attention are provided in addition to salary, with low living costs, pension scheme and kit allowance. Age limits, 25 to 40 years. Apply, with full particulars of qualifications, experience, etc., to **BOX No. 5933, c/o CHARLES BARKER & SONS, LTD., 31, BUDGE ROW, CANNON STREET, LONDON, E.C.4.**

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CHARCOAL, ANIMAL AND VEGETABLE, horticultural, burning, filtering, disinfecting, medicinal-insulating; also lumps ground and granulated; established 1830; contractors to H.M. Government.—**THOS. HILL-JONES, LTD., "INVICTA" MILLS, BOW COMMON LANE, LONDON, E. TELEGRAMS: "HILL-JONES, BOCHURCH LONDON," TELPHONE 3285 EAST**

DELAFILA, THE INERT FILLER. Used in the manufacture of Fertilisers, Insecticides, Paints, Plastics and Insulating and Sealing Compounds. Prompt supplies in a wide range of fineness grades. **THE DELABOLE SLATE CO., LTD., DELABOLE, CORNWALL.**

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Two 4,000-gal. Unused W.S. Enclosed **TANKS**—15 ft. by 7 ft. by 7 ft. by $\frac{1}{8}$ in. plate.

Unused **CONDENSERS**—"Weir" brass tubes, 100 sq. ft. and six—3 ft. 6 in. by 5 in. with 325—$\frac{1}{2}$ in. copper tubes. Various others by "Serck."

Stainless Steel Drum **MIXER,** 4 ft. by 2 ft. wide.

W.S. Jacketed **PANS** or **MIXERS**—30, 50, 300 and 1,375 gallons.

Cylindrical, Rectangular and Sectional **TANKS** up to 16,000 gallons.

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FIVE new **FURNACE RETORTS,** 8 ft. diam., 6 ft. 8 in. deep, approx. 8 tons each.

BENZOLE WASHER, lead lined, agitating gear, 7 ft. diam., 6 ft. 6 in. deep.

FIVE Dish-ended **NAPHTHA TANKS,** 18 ft. 6 in. long by 4 ft. 4 in. diam., two having agitators.

NINE New Welded **TANKS,** 13 ft. 6 in. long, 7 ft. diam., 3,100 gallons each.

TWO 35 ft. long by 9 ft. diam. Lead-lined **TANKS.**

Stainless Steel **FILTER TANK,** 3 ft. 6 in. diam.

TWO Stainless **CONICAL HOPPERS,** 1,200 gallons, 8 ft. 3 in. diam., overall depth, 7 ft. 6 in.

TWO Broadbent **WATER-DRIVEN CENTRIFUGES,** 30 in. diam., 12 in. deep, 1,150 r.p.m., 150 lb. pressure.

FOUR Papier-mache **O.T. TANKS,** 8 ft. 6 in. diam., 8 ft. deep. (Unused.)

SIX **O.T. TANKS,** 7 ft. diam. 14ft. deep, lined inside with acid-resisting bricks.

SIX Aluminium **CONDENSERS,** 14 ft. long by 2 ft. 6 in. diam. 386 Tubes, $\frac{3}{4}$ in. o.d.

FOUR Rectangular Lead-lined **TANKS,** 8 ft. by 4 ft. 6 in. by 2 ft. 6 in.

FORTY Riveted **RECEIVERS,** 8 ft. 6 in. long, 5 ft. 6 in. diam., 75 lbs. w.p.

CAST-IRON PIPES and FITTINGS, 200 tons.

VALVES in Stainless, Gunmetal, Enamel Lined.

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NEW steel **DRUMS** in most capacities and types, available for immediate delivery at official prices. Consult **STEEL DRUMS LTD., 118, BURDON LANE SUTTON, SURREY. VIGILANT 4886.**

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THREE Cambridge Single-point 'Model "D" **RECORDING POTENTIOMETERS,** taking monthly charts, calibrated 4-9 *pH* units with manual temperatures compensation 0-50° C., fitted with single adjustable alarm contact (10 amp. mercury switches) to open on rising *pH* value. Complete with thermionic potentiometers and submersible type glass/calomel electrodes and 50 feet cable.

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FOR SALE

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TWO 1½ size Harrison Carter **DISINTEGRATORS.**

One **FILTER PRESS** by Johnson, with 15 steam jacketed plates 13" × 13" and 16 frames.

One plate and frame **PRESS** by Johnson with 22 C.I. plates and 23 frames, 4-port type.

One Jeffrey **GRINDER,** 72 loose hammers, shaker feed

Two Turner 2½-sheet No. 2 **DRESSING MACHINES,** ball bearing.

Size No. 3 Junior Hammamac **HAMMER MILL** with fan and cyclone, also No. 1 size Miracle **GRINDING MILLS.**

Robinson 3-sheet No. 1 size **CENTRIFUGAL DRESSING MACHINE** for dry powders, etc.

Four ROTARY BOWL MIXERS. 5 ft. diam., cast-iron built, inclined agitators by Baker Perkins

One excellent **EVAPORATING UNIT,** comprising Copper Vessel, 4 ft. diam. by 5 ft. 6 in. deep, jacketed on the bottom, with copper swan-neck, C.I. catch-pot, vacuum pump and fittings including thermometer and gauge.

Large unjacketed **WERNER MIXER,** belt and gear driven, hand tipping, double " Z " arms, pans 31 in. by 45 in. by 36 in. deep.

No. 200 One nearly new **WERNER PFLEIDERER JACKETED MIXER OR INCORPORATOR.** Low type with C.I. built mixing chamber. 28 in. by 29 in. by 27 in. deep, with double " U "-shaped bottom which is jacketed, and double fish-tail or fin-type agitators geared together at one side, with belt-driven friction pulleys, 34 in. diam. by 5 in. face, with hand-wheel operation and hand-operated screw tilting gear. Machine fitted with machine-cut gears, covers, gear guard, cast-iron baseplate, and measuring overall approximately 7 ft. by 6ft. by 4 ft. high to the top of the tipping screw

No. 209 One **HORIZONTAL " U "-SHAPED MIXER,** steel built, riveted, measuring about 8 ft. 3 in. long by 3 ft. wide by 3 ft. 3 in. deep, with horizontal shaft, fitted with bolted-on mixing arms about 18 in. long by 4 in. wide, with intermediate breakers, and driven at one end by a pair of spur gears, with countershaft, fast and loose belt pulleys, outer bearing and plug cock type outlet at the opposite end, mounted on two cradles fitted to two R.S.J. running from end to end.

Two **FILTER PRESSES,** each fitted 68 wood recessed plates, 2 ft. 8 in. square, centre fed, with enclosed bottom corner delivery, cloth clips and belongings.

One **DEHNE FILTER PRESS,** cast-iron built, fitted 45 recessed ribbed plates, 2 ft. 8 in. by 2 ft. 8 in. by 1⅜ in., with bottom corner feed, cloth clips and bottom corner separate outlets, angle lever closing gear, etc.

SIMON HORIZONTAL TUBULAR STEAM-HEATED DRIER, barrel with steam-heated tubes, 12 ft. long by 5 ft. diameter.

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DE-AIRING Type **PUG MILL** by Bonnot. Primary chamber 4 in. diam., secondary worm extruder 3 in. diam.—3 in. discharge with 7½ in. by 9 in. opening. Of aluminium construction, with stainless steel shaft and worms. Motorised 220/440/3/50.

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Carton Filling, Packing, Wrapping and Labelling Machine by **SOCIETE INDUSTRIELLE SUISSE** adjustable for cartons from 73 mm. sq. by 38 mm to 65.6 mm. sq. by 38 mm. Motorised 400/3/50. Complete with label attachments and heat sealing device. Conveyor feed approx. 55 per min.

100 gal. Stainless Steel **AGEING VAT,** 2 ft. 9 in. diam. by 2 ft. 10 in. deep. 1½ in. bottom outlet. Fitted water jacket with freezing coil. Hinged cover with vertical agitator shaft fitted two 18 in. propellors. Motorised 230V A.C. Complete with condensing unit.

" Cannon " 25 gal. Stainless Steel-lined **EVAPORATING PAN,** 3 ft. diam. by 10 in. deep. Steam jacketed.

Vertical **COPPER STILL,** 6 ft. diam. by 6 ft. deep, on straight with domed top and concave bottom. 18 in. bolted cover on top. Bolted manhole cover in centre of side. Fitted L.P. 2½ in. diam. steam coil. 4 ft. p.c.d., 7 turns. Fractionating column 15 ft. by 1 ft. 9 in. diam., of copper construction and contains 30 trays.

Three Steam-heated **WATER STILLS** by Manesty, Type 4. Capacity, 50 g.p.h. each. Steam consumption 667 lb./hr. at 20-45 lb. sq. in. 450 gals. cooling water required per hour.

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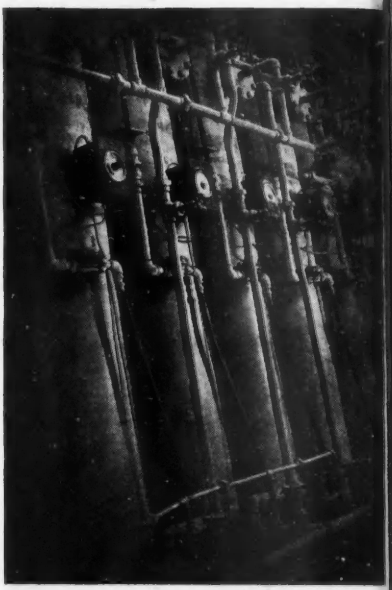

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